



48MPD,MPE62L-10R
50MP62L-10R

**Single Package Electric Cooling Units
and Gas Heating/Electric Cooling Units
With Product Integrated Controls**

Installation, Start-Up and Service Instructions

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Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

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GENERAL

This installation instruction contains base unit installation, start-up, and service instructions only. For complete information on PIC (Product Integrated Controls) controls and troubleshooting, refer to separate Controls and Troubleshooting literature also enclosed in this literature packet.

IMPORTANT:

1. Tune all loops immediately after starting units. Refer to Control Loop Checkout section on page 40 for more information on tuning loops.
2. The Data Reset function should be performed any time one or more of the unit factory configuration values are changed.
3. The HSIO (human sensor input/output) keypad and display module is required for initial start-up of unit. All units are shipped in STANDBY mode. The HSIO must be used to change the unit to RUN mode. The HSIO is not required for normal operation, however, at any time the unit needs to be transferred back into STANDBY mode, such as when servicing a unit, it must be done with the HSIO.

SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment.

Untrained personnel can perform basic maintenance functions of cleaning coils and filters and replacing filters. All other operations should be performed by trained service personnel. When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply.

Follow all safety codes, including ANSI (American National Standards Institute) Z223.1. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguisher available for all brazing operations.

⚠ WARNING

Before performing service or maintenance operations on unit, turn off main power switch to unit. Electrical shock could cause personal injury.

FOR YOUR SAFETY

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

⚠ WARNING

Improper installation, adjustment, alteration, service, or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information, consult a qualified installer or service agency.

⚠ WARNING

This unit uses a microprocessor-based electronic control system. Do not use jumpers or other tools to short out components, or to bypass or otherwise depart from recommended procedures. Any short-to-ground of the control board or accompanying wiring may destroy the electronic modules or electrical components.

⚠ CAUTION

Disconnect gas piping from 48 Series units when leak testing at pressures greater than 0.5 psig. Pressures greater than 0.5 psig will cause gas valve damage resulting in a hazardous condition. If gas valve is subjected to pressure greater than 0.5 psig, it must be replaced. When pressure testing field-supplied gas piping at pressures of 0.5 psig or less, the unit connected to such piping must be isolated by manually closing the gas valve.

INSTALLATION

Jobsite Survey — Complete the following checks before installation.

1. Consult local building codes and the NEC (National Electrical Code) (ANSI/NFPA [National Fire Protection Association] 70) for special installation requirements.
2. Determine unit location (from project plans) or select unit location.
3. Check for possible overhead obstructions which may interfere with unit lifting or rigging.

⚠ CAUTION

Do not lift unit with forklift truck. Move unit with overhead rigging only.

Unit Placement — Inspect unit for transportation damage. File claim with transportation agency.

Provide clearance around and above unit for airflow, safety, and service access. Do not restrict top (area above condenser fans) in any way. Allow at least 6 ft on all sides for rated performance, code compliance, and service.

Check unit dimensional drawings for unit arrangement and minimum performance and service clearances.

Do not install unit in an indoor location. Do not locate air inlets near exhaust vents or other sources of contaminated air.

On units equipped with power exhaust option, high velocity air is exhausted out the hood. Unit should be positioned with at least 10 ft clearance between the exhaust hood and any obstruction. Although unit is weatherproof, guard against water from higher level runoff and overhangs.

Level by using unit frame as a reference. Physical data is shown in Tables 1-4.

Roof Mount — Check building codes for weight distribution requirements. Unit weight is shown in Table 1. Unit may be mounted on class A, B, or C roofing material.

ROOF CURB — Assemble and install as described in instructions shipped with the accessory. Accessory roof curb and information required to field fabricate a roof curb is shown in Fig. 1 and 2. Install insulation, cant strips, roofing, and counter flashing as required. For unit condensate drain to function properly, curb must be level or within tolerances shown in Fig. 1 and 2.

STEEL BEAMS — If roof curb is not used, support unit with steel beams along its entire length and then support steel as required. As a minimum, unit must be supported across its width at each lifting lug location.

Slab Mount — Provide a level concrete slab that extends beyond unit cabinet at least 6 inches. Make a slab 8 in. thick with 4 in. above grade. Use gravel apron in front of condenser coil air inlet to prevent grass and foliage from obstructing airflow. Ensure that slab is of sufficient height to allow for 7-in. condensate trap.

Field-Fabricated Ductwork — Units are designed for vertical supply/return only. Field-fabricated ductwork should be attached to the roof curb. Supply and return duct dimensions are shown in Fig. 1-6.

To attach ductwork to roof curb, insert duct approximately 10 to 11 in. up into roof curb. Connect ductwork to 14-gage roof curb material with sheet metal screws driven from inside of the duct.

Secure all ducts to the building structure, using flexible duct connectors between roof curb and ducts as required. Ducts passing through an unconditioned space must be insulated and covered with a vapor barrier. Outlet grilles must not lie directly below unit discharge. The return duct must have a 90-degree elbow before opening into the building space if unit is equipped with power exhaust.

Design supply duct strong enough to handle expected static pressures.

⚠ WARNING

For vertical supply and return units, tools or parts could drop into ductwork and cause an injury. Install 90 degree turns in the supply and return ductwork between the unit and the conditioned space. If a 90 degree elbow cannot be installed, then grilles of sufficient strength and density should be installed to prevent objects from falling into the conditioned space.

Rigging — Do not drop unit; keep upright. Use spreader bars over unit to prevent sling or cable damage. Leave condenser coil shipping protection in place while rigging to prevent coil damage. All lifting lugs MUST be used when lifting unit.

Level by using unit frame as a reference. See Fig. 7 for information. Unit and accessory weights are shown in Tables 1-4. Weight distribution and center of gravity can be found in Fig. 8.

Condensate Drains — The condensate drain connection is a 1 ½-in. NPT pipe connection located on the right hand side of the unit. See Fig. 9.

NOTE: Use a trap of at least 7-in. deep.

Condenser Coil Shipping Covers — Remove and discard.

Install Outdoor Hoods

1. Outdoor-air hoods are shipped bolted to the unit in a shipping position. To open hoods, remove the 3 holdown bars holding the air hood in shipping position. See Fig. 10.
2. Lift up the highest hood top and swing out hood sides to form the outside frame of the air hood. Fasten hood top to hood sides at middle and top holes only, using two screws on each side. See Fig. 11.
3. Remove the bottom hood block-off plate and set aside.
4. Swing up second hood (from the top of unit) into place and fasten to hood sides with screws provided using upper hole only.
5. Swing up third hood (from the top of unit) into place and fasten to hood sides with screws provided using upper hole only.
6. Swing up fourth hood (bottom hood) into place. Before fastening hood to hood sides, swing down bottom filter rack. Fasten hood to hood sides with screws provided using upper hole only.
7. Attach block off plate removed from Step 3.
8. Clip wire tie holding filter track. Swing filter track into position and fasten to hood sides using screws provided. Repeat until all 4 filter racks have been installed.
9. Apply a bead of RTV or similar sealant to corner of each hood at pivot point to prevent water leaks.

Copy continues on page 14.

Table 1 — Physical Data

BASE UNIT 48/50MP	62L	70M	82N
NOMINAL CAPACITY (tons)	80	90	105
OPERATING WEIGHT (lb)			
Base Unit (48MP/50MP)	16,810/16,550	18,060/17,800	22,660/22,400
Copper Condenser Coils	675	725	725
Exhaust Fan	1,675	1,775	2,375
COMPRESSORS		Semi-Hermetic	
Number of Refrigerant Circuits	2	2	2
Circuit (No. of Cylinders)	A (6) -299 19	B (6) -299 19	A1 (6), A2 (4) -275, -250 19, 14
Model 06E			-299 19
Oil Charge (pints)			18,26,35,44,53,56,65,74,82,91,100
Capacity Steps (%)	17,33,50,67,83,100	11,22,33,41,56,67,78,89,100	
REFRIGERANT		R-22	
Operating Charge (lb), Sys 1/Sys 2 (Standard Coil)	78/78 83/83	85/82 94/85	85/82
Operating Charge (lb), Sys 1/Sys 2 (Alternate Coil)			92/88
CONDENSER COILS		Grooved Tube (3/8-in. OD)	
Quantity	4	4	4
Rows...Fins/in.	3...17 116.7	3...17 128.3	3...17 128.3
Total Face Area (sq ft)			
EVAPORATOR COILS		Smooth Tube (3/8-in. OD)	
Quantity	2	2	2
Rows...Fins/in.			
Standard	3...14	3...14	3...14
Alternate	4...14 62.6	4...14 70.0	4...14 82.0
Total Face Area (sq ft)			
Refrigerant Feed			
Device...No. per Circuit	TXV...2	TXV...2	TXV...2
EVAPORATOR FANS			
Forward Curved Fan			
Motor Hp	30	40	50
Motor Frame Size	286T	324T	326T
Efficiency at Full Load (%)			
Standard Efficiency	92.4	93.0	93.0
High Efficiency	93.6	94.5	94.5
Fan Pulley Pitch Diameter (in.)	18.4	16.0	15.4
Motor Pulley Pitch Diameter (in.)	6.2	6.4	5.6
Fan Rpm	608	705	658
Belts Quantity...Model No.	3...BX128	4...BX124	5...BX124
Center Distance Range (in.)	42.1-46.1	43.1-48.2	43.1-48.2
Maximum Rpm	835	835	835
Air Foil Fan			
Motor Hp	30	40	50
Motor Frame Size	286T	324T	326T
Efficiency at Full Load (%)			
Standard Efficiency	92.4	93.0	92.4
High Efficiency	93.6	94.5	93.6
Fan Pulley Pitch Diameter (in.)	11.0	12.4	12.4
Motor Pulley Pitch Diameter (in.)	7.4	9.4	9.4
Fan Rpm	1192	1337	1337
Belts Quantity...Model No.	3...B111	3...B120	3...B120
Center Distance Range (in.)	39.7-43.7	40.4-45.2	40.4-45.2
Maximum Rpm	1595	1595	1595
Air Foil Fan (cont)			
Motor Hp	50	60	60
Motor Frame Size	326T	364T	364T
Efficiency at Full Load (%)			
Standard Efficiency	93.0	94.5	94.5
High Efficiency	94.5	95.4	95.4
Fan Pulley Pitch Diameter (in.)	9.1	8.1	8.1
Motor Pulley Pitch Diameter (in.)	7.5	7.1	7.1
Fan Rpm	1442	1534	1534
Belts Quantity...Model No.	3...5VX1120	4...5VX1080	4...5VX1030
Center Distance Range (in.)	40.4-45.2	39.4-44.9	34.4-39.1
Maximum Rpm	1595	1595	1298
CONDENSER FANS			
Quantity...Diameter (in.)	6...30	6...30	6...30
Nominal Cfm	52,000	52,000	52,000
Motor Hp...Rpm	1...1140	1...1140	1...1140
SUPPLY FAN			
Nominal Cfm	Forward Curve 32,000	Airfoil 32,000	Forward Curve 42,000
Size (in.)	30.0	33.0	36.0
Maximum Allowable Rpm	835	1595	715
Shaft Diameter at Pulley (in.)	2.69	2.44	2.69
FURNACE SECTION (48MP Units Only)			
Rollout Switch Cutout Temp (F)	190		190
Number of Burners	7		7
Burner Orifice Diameter (in. ...drill size)	0.136...0.29		0.136...0.29
Gas Input (Btuh)	342,000		342,000
Manifold Pressure (in. wg) — Natural Gas	3.3		3.3
Gas Valve Input Pressure Range			
in. wg	5.5-13.5		5.5-13.5
psig	0.235-0.487		0.235-0.487
LOW HEAT (48MPD)/HIGH HEAT (48MPE)			
Number of Sections		2/3	2/3
Gas Input (Btuh)	515,000/770,000		515,000/770,000
Stage 1	685,000/1,025,000		685,000/1,025,000
Stage 2	81/81		81/81
Efficiency (Steady State %)			
Temperature Rise Range (F)	10-40/20-50		5-35/10-40
Minimum Heating Airflow (cfm)	12,850/15,400		14,700/19,250
Field Gas Connection Size (in.)	2		2
FILTERS			
Medium Efficiency (30%)			
Pleated (Standard)			
Quantity...Size (in.)	15...24 x 24 x 2, 5...24 x 12 x 2		20...24 x 24 x 2, 5...24 x 12 x 2
High Efficiency (90%) Cartridge Filters with Prefilters (Optional)	15...24 x 24 x 4, 5...24 x 12 x 4	15...24 x 24 x 4, 5...24 x 12 x 4	20...24 x 24 x 4, 5...24 x 12 x 4
Quantity...Size (in.)			
Outdoor Air Inlet Screens		Cleanable Aluminum	
Quantity...Size (in.)	16...20 x 25 x 1	16...20 x 25 x 1	24...20 x 25 x 1

LEGEND

TXV — Thermostatic Expansion Valve

Table1 — Physical Data (cont)

BASE UNIT 48/50MP	90P	10R		
NOMINAL CAPACITY (tons)	115	120		
OPERATING WEIGHT (lb) Base Unit (48MP/50MP) Copper Condenser Coils Exhaust Fan	24,660/24,750 950 2400	25,110/25,100 950 2400		
COMPRESSORS Number of Refrigerant Circuits Circuit (No. of Cylinders) Model 06E Oil Charge (pints) Capacity Steps (%)	A1 (6), A2 (6) -265, -275 19, 19 15,23,30,38,45,58,65,73,85,92,100 2	B1 (6), B2 (6) -265, -275 19, 19 14,21,28,35,42,61,68,75,86,93,100 Semi-Hermetic	A1 (6), A2 (6) -265, -299 19, 19 19, 19 B1 (6), B2 (6) -265, -275 19, 19 14,21,28,35,42,61,68,75,86,93,100 2	
REFRIGERANT Operating Charge (lb), Sys 1/Sys 2 (Standard Coil) Operating Charge (lb), Sys 1/Sys 2 (Alternate Coil)	85/85 93/93	R-22 86/87 93/96		
CONDENSER COILS Quantity Rows...Fins/in. Total Face Area (sq ft)	4 3...17 168.0	Grooved Tube (%-in. OD) 4 3...17 168.0		
EVAPORATOR COILS Quantity Rows...Fins/in. Standard Alternate Total Face Area (sq ft) Refrigerant Feed Device...No. per Circuit	2 3...14 4...14 90.3	Smooth Tube (%-in. OD) 2 3...14 4...14 101.4		
EVAPORATOR FANS Forward Curved Fan Motor Hp Motor Frame Size Efficiency at Full Load (%) Standard Efficiency High Efficiency Fan Pulley Pitch Diameter (in.) Motor Pulley Pitch Diameter (in.) Fan Rpm Belts Quantity...Model No. Center Distance Range (in.) Maximum Rpm Air Foil Fan Motor Hp Motor Frame Size Efficiency at Full Load (%) Standard Efficiency High Efficiency Fan Pulley Pitch Diameter (in.) Motor Pulley Pitch Diameter (in.) Fan Rpm Belts Quantity...Model No. Center Distance Range (in.) Maximum Rpm Air Foil Fan (cont) Motor Hp Motor Frame Size Efficiency at Full Load (%) Standard Efficiency High Efficiency Fan Pulley Pitch Diameter (in.) Motor Pulley Pitch Diameter (in.) Fan Rpm Belts Quantity...Model No. Center Distance Range (in.) Maximum Rpm	50 326T 93.0 94.5 18.8 5.9 555 4...5VX1120 35.4/40.2 715 50 326T 93.0 94.5 12.5 7.5 1050 3...5VX1030 35.4/39.4 1298 75 365T 95.4 — 16.1 11.1 1207 3...5VX1120 34.4/39.1 1298	60 364T 94.5 95.4 18.8 6.7 630 4...5VX1120 35.4/40.2 715 60 364T 94.5 95.4 13.7 8.7 1111 3...5VX1060 34.4/39.1 1298 50 326T 93.0 94.5 13.7 8.1 1035 3...5VX1060 35.4/39.4 1298 60 364T 94.5 95.4 13.7 8.7 1111 3...5VX1060 34.4/39.1 1298 75 365T 95.4 — 16.1 11.1 1207 3...5VX1120 34.4/39.1 1298	60 364T 94.5 95.4 21.3 6.7 556 4...5VX1150 34.2/40.2 715 50 326T 93.0 94.5 13.7 8.1 1035 3...5VX1060 35.4/39.4 1298 60 364T 94.5 95.4 13.7 8.7 1111 3...5VX1060 34.4/39.1 1298 75 365T 95.4 — 16.1 11.1 1207 3...5VX1120 34.4/39.1 1298	
CONDENSER FANS Quantity...Diameter (in.) Nominal Cfm Motor Hp...Rpm	8...30 69,500 1...1140	8...30 69,500 1...1140		
SUPPLY FAN Nominal Cfm Size (in.) Maximum Allowable Rpm Shaft Diameter at Pulley (in.)	Forward Curve 46,000 36.0 715 2.69	Airfoil 46,000 40.25 1298 2.44	Forward Curve 52,000 36.0 715 2.69	Airfoil 52,000 40.25 1298 2.44
FURNACE SECTION (48MP Units Only) Rollout Switch Cutout Temp (F) Number of Burners Burner Orifice Diameter (in. ...drill size) Gas Input (Btuh) Manifold Pressure (in. wg) — Natural Gas Gas Valve Input Pressure Range in. wg psig			190 7 0.136...29 342,000 3.3 5.5-13.5 0.235-0.487	
LOW HEAT (48MPD)/HIGH HEAT (48MPE) Number of Sections Gas Input (Btuh) Stage 1 Stage 2 Efficiency (Steady State %) Temperature Rise Range (F) Minimum Heating Airflow (cfm) Field Gas Connection Size (in.)			2/3 515,000/770,000 685,000/1,025,000 81/81 5-35/10-40 14,700/19,250 2	
FILTERS Medium Efficiency (30%) Pleated (Standard) Quantity...Size (in.) High Efficiency (90%) Cartridge Filters with Prefilters (Optional) Quantity...Size (in.) Outdoor Air Inlet Screens Quantity...Size (in.)	20...24 x 24 x 2, 5...24 x 12 x 2 20...24 x 24 x 4, 5...24 x 12 x 4 24...20 x 25 x 1	Cleanable Aluminum	20...24 x 24 x 2, 5...24 x 12 x 2 20...24 x 24 x 4, 5...24 x 12 x 4 24...20 x 25 x 1	

LEGEND

TXV — Thermostatic Expansion Valve

Table 2 — Optional Power Exhaust Specifications

UNIT 48/50MP		62L		70M		82N	
Type		100% Mod	100% Non Mod	100% Mod	100% Non Mod	100% Mod	100% Non Mod
Motor Hp	30	30	30	40	40	40	40
Motor Frame Size	286T	286T	286T	324T	324T	324T	324T
Efficiency at Full Load (%)							
Standard Efficiency	92.4	92.4	93.0	93.0	93.0	93.0	93.0
High Efficiency	93.6	93.6	94.5	94.5	94.5	94.5	94.5
Fan Pulley Pitch Diameter (in.)	18.4	18.4	18.4	18.4	18.4	25.0	20.0
Motor Pulley Pitch Diameter (in.)	5.6	6.0	6.2	6.6	6.8	5.8	5.8
Fan Rpm	552	590	608	646	491	526	
Belts Quantity...Model No.	4...BX80	4...BX81	5...BX80	5...BX80	5...B90	5...BX90	
Center Distance Range (in.)	19.9-23.3	19.9-23.3	18.6-22.8	18.6-22.8	21.8-25.9	21.8-25.9	
Maximum Allowable Rpm	650	650	835	835	560	560	
Type		50% Non Mod		50% Non Mod		50% Non Mod	
Motor Hp		7.5		7.5		7.5	
Motor Frame Size		213T		213T		213T	
Efficiency at Full Load (%)							
Standard Efficiency	88.5		88.5			88.5	
High Efficiency	91.7		91.7			91.7	
Fan Pulley Pitch Diameter (in.)	15.4		16.0			18.4	
Motor Pulley Pitch Diameter (in.)	3.6		3.6			3.6	
Fan Rpm	412		397			346	
Belts Quantity...Model No.	2...BX75		2...BX77			2...BX90	
Center Distance Range (in.)	21.3-24.1		21.7-24.2			24.9-27.4	
Maximum Allowable Rpm	690		650			600	

Table 2 — Optional Power Exhaust Specifications (cont)

UNIT 48/50MP		90P		10R	
Type		100% Mod	100% Non Mod	100% Mod	100% Non Mod
Motor Hp	50	50	60	60	60
Motor Frame Size	326T	326T	364T	364T	
Efficiency at Full Load (%)					
Standard Efficiency	93.0	93.0	94.5	94.5	
High Efficiency	94.5	94.5	95.4	95.4	
Fan Pulley Pitch Diameter (in.)	28.1	28.1	28.1	28.1	
Motor Pulley Pitch Diameter (in.)	8.1	8.1	9.1	9.1	
Fan Rpm	508	508	558	558	
Belts Quantity...Model No.	3...5VX1060	3...5VX1060	3...5VX1060	3...5VX1060	
Center Distance Range (in.)	21.8-25.9	21.8-25.9	20.9-25.6	20.9-25.6	
Maximum Allowable Rpm	560	560	560	560	
Type		50% Non Mod		50% Non Mod	
Motor Hp		10		15	
Motor Frame Size		215T		254T	
Efficiency at Full Load (%)					
Standard Efficiency	89.5		89.5		
High Efficiency	91.7		91.7		
Fan Pulley Pitch Diameter (in.)	20.0		20.0		
Motor Pulley Pitch Diameter (in.)	4.5		4.0		
Fan Rpm	362		371		
Belts Quantity...Model No.	2...BX90		3...BX90		
Center Distance Range (in.)	24.9-27.4		23.9-26.8		
Maximum Allowable Rpm	600		600		

Table 3 — Compressor Oil Charge

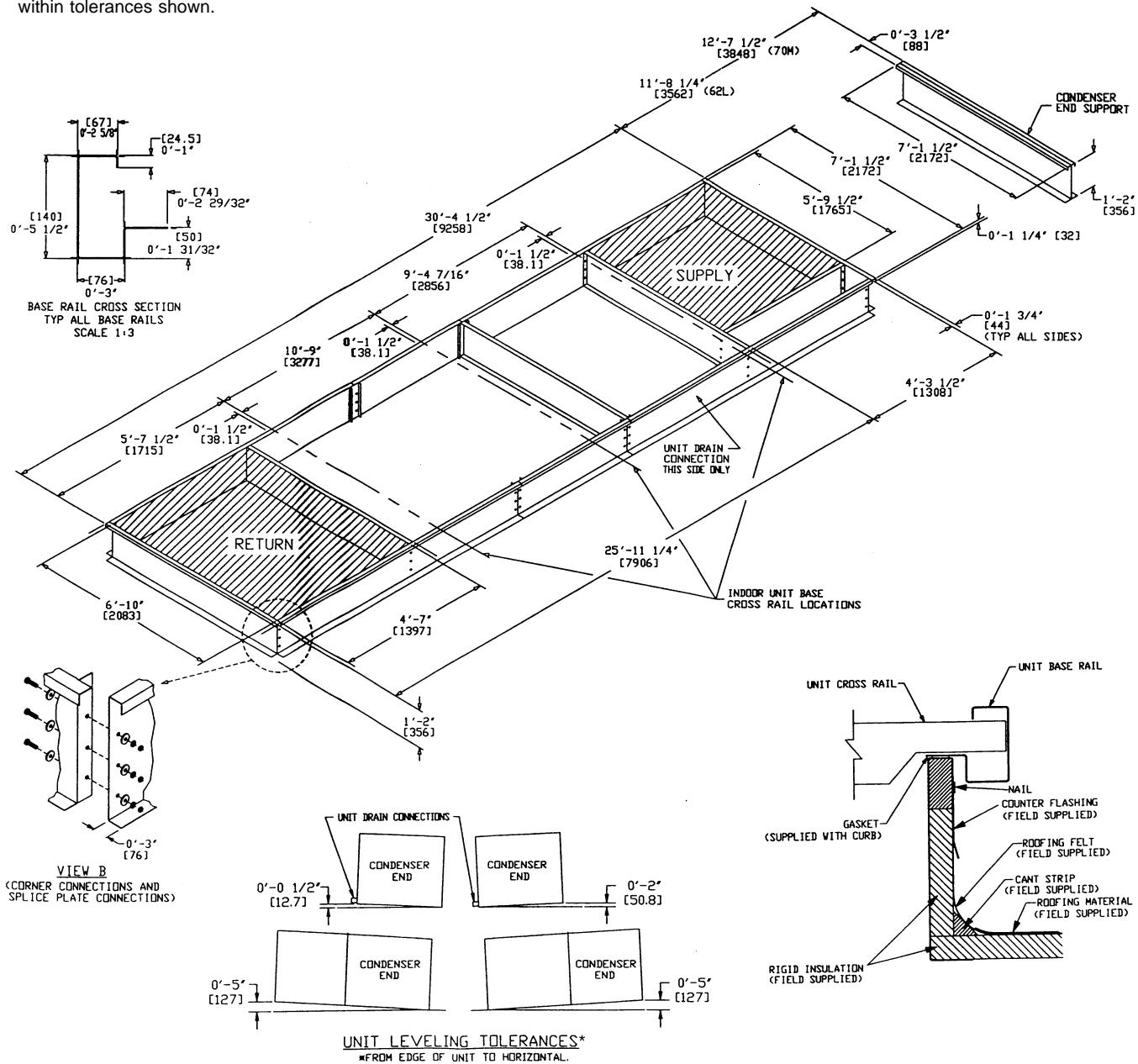
UNIT 48/50MP	OIL CHARGE (pints)					
	Compressor Circuit A		Total Circuit A	Compressor Circuit B		Total Circuit B
	A1	A2		B1	B2	
62L	19	—	19	19	—	19
70M	19	14	33	19	—	19
82N	19	14	33	19	19	38
90P	19	19	38	19	19	38
10R	19	19	38	19	19	38

Table 4 — Variable Frequency Drive (VFD) Physical Data

FAN MOTOR HP	DIMENSIONS (in.)			WEIGHT (lb)
	Height	Width	Length	
30	24.02	12.99	11.22	68
40	24.02	12.99	11.22	68
50	30.91	12.99	11.22	106
60	30.91	12.99	11.22	106
75	33.46	12.99	11.22	106

NOTES:

1. Roof curb is shipped disassembled.
2. Roof curb: 14 gage [VA03-56] steel.
3. Dimensions in [] are in millimeters.
4. To prevent standing water in the drain pan of the indoor section, roof curb and unit must be level within tolerances shown.



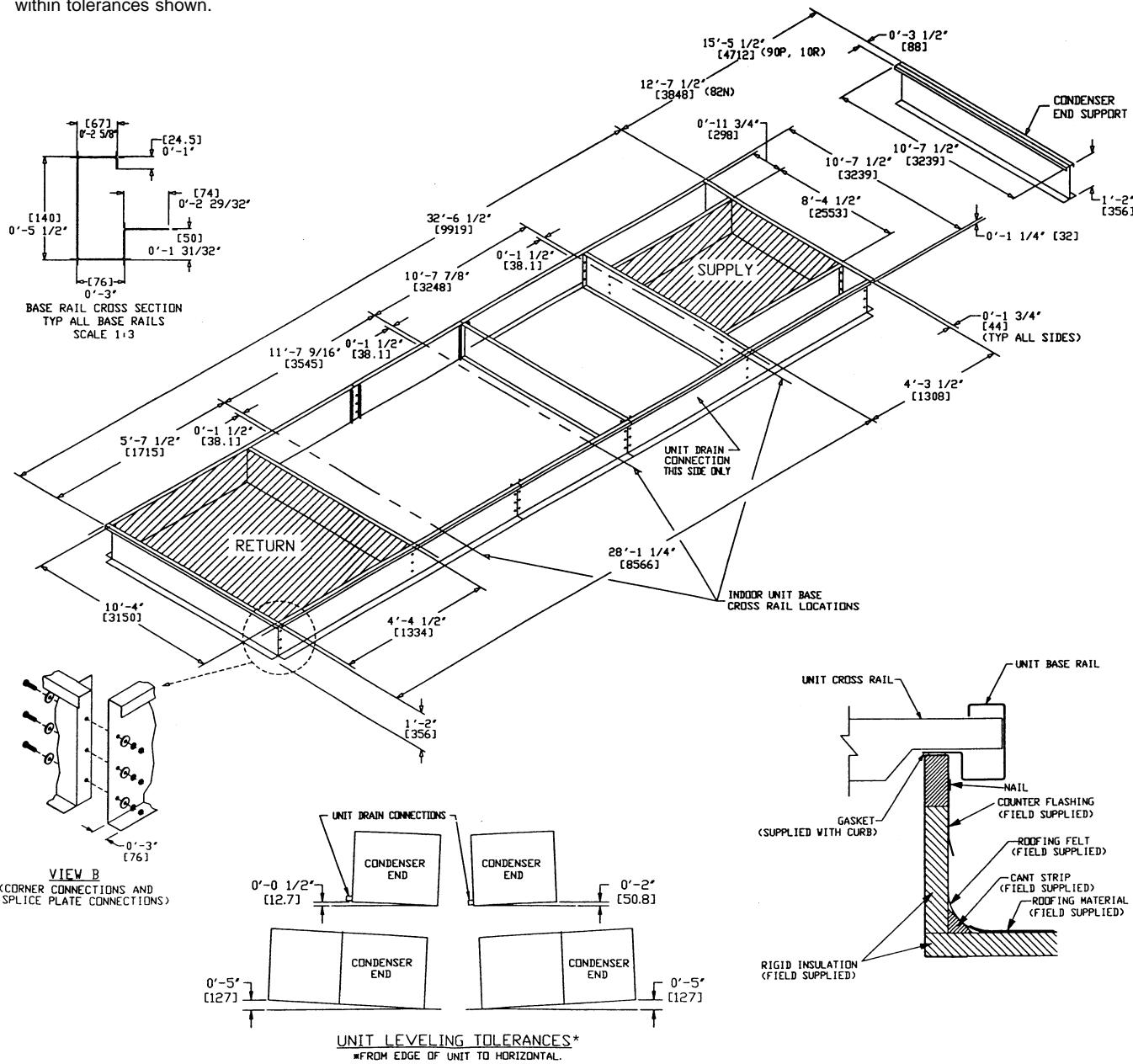
NOTES:

1. To prevent the hazard of stagnant water build-up in the drain pan on the indoor section, unit cannot exceed leveling tolerances shown.
2. If a Carrier roof curb is not used, curb cross rails must be positioned to clear unit base rail locations shown.

Fig. 1 — Roof Curb Dimensions, 48/50MP62L and 70M

NOTES:

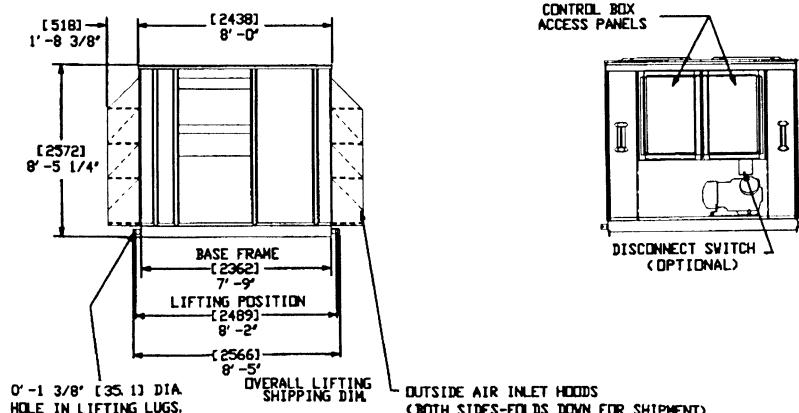
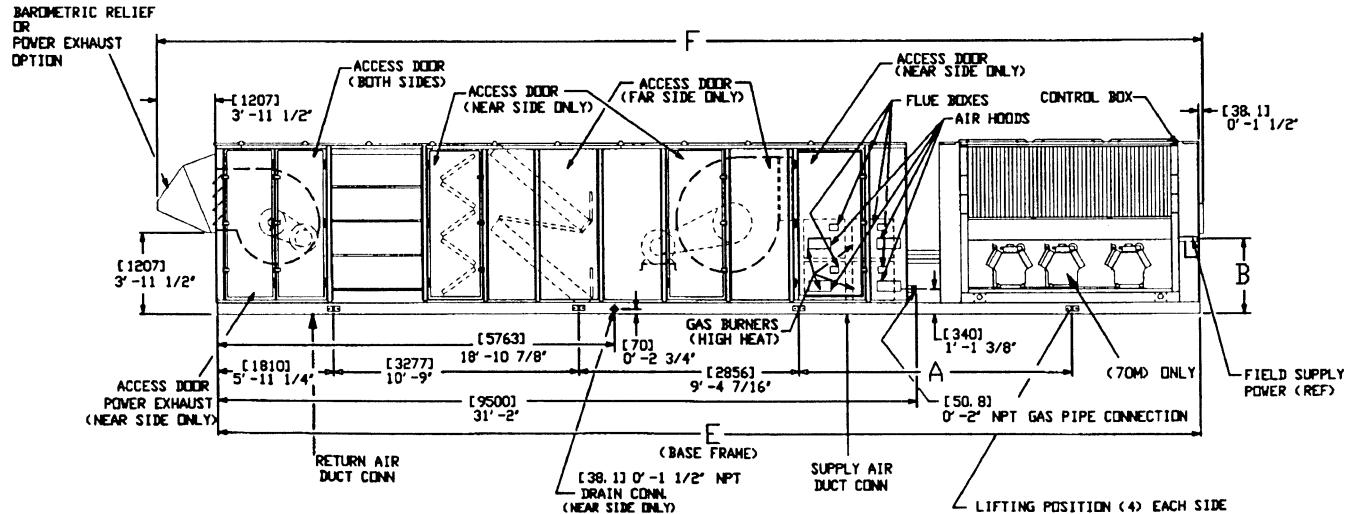
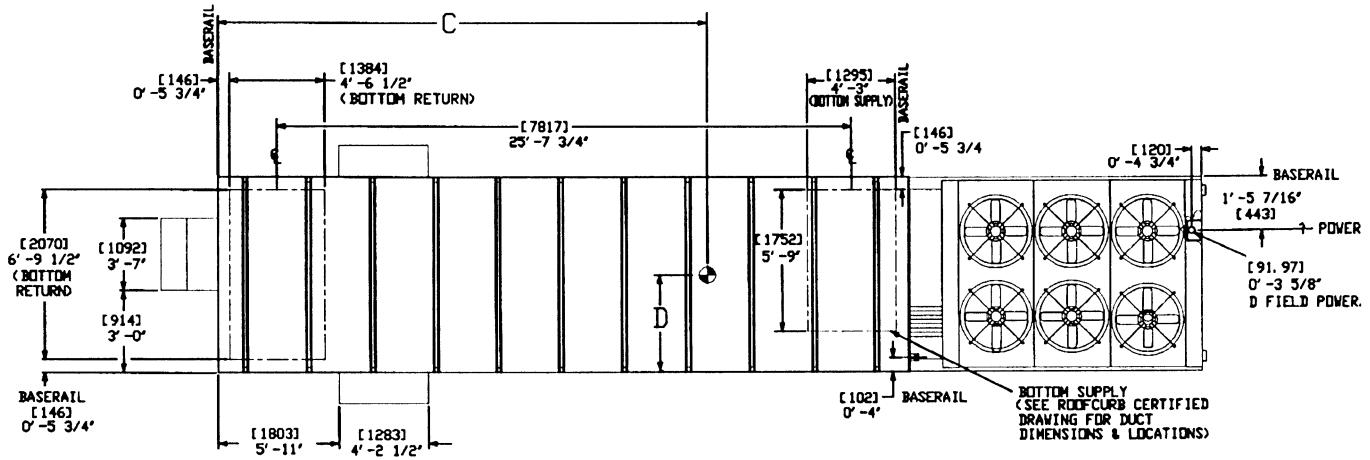
1. Roof curb is shipped disassembled.
2. Roof curb: 14 gage [VA03-56] steel.
3. Dimensions in [] are in millimeters.
4. To prevent standing water in the drain pan of the indoor section, roof curb and unit must be level within tolerances shown.



NOTES:

1. To prevent the hazard of stagnant water build-up in the drain pan on the indoor section, unit cannot exceed leveling tolerances shown.
2. If a Carrier roof curb is not used, curb cross rails must be positioned to clear unit base rail locations shown.

Fig. 2 — Roof Curb Dimensions, 48/50MP82N-10R

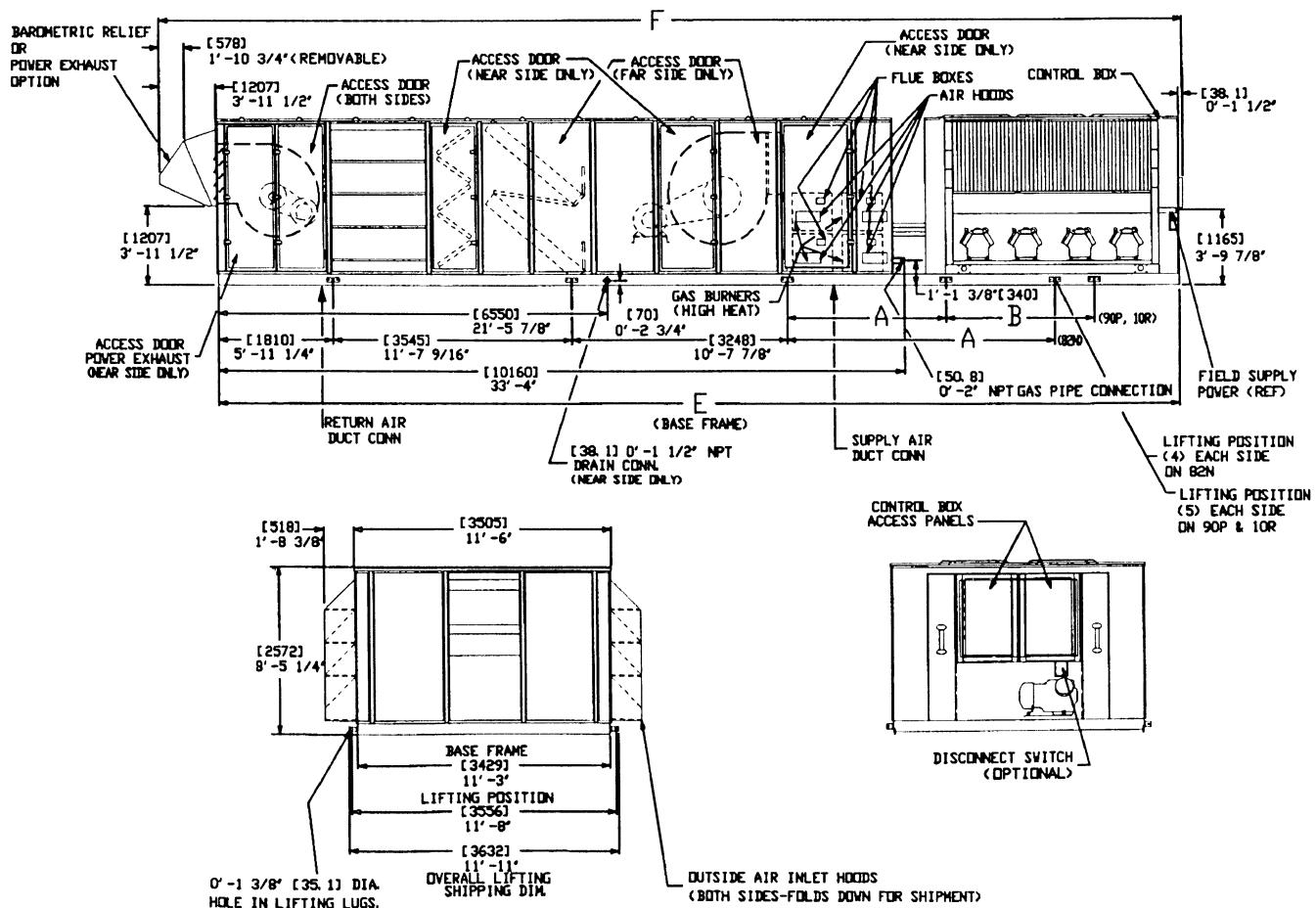
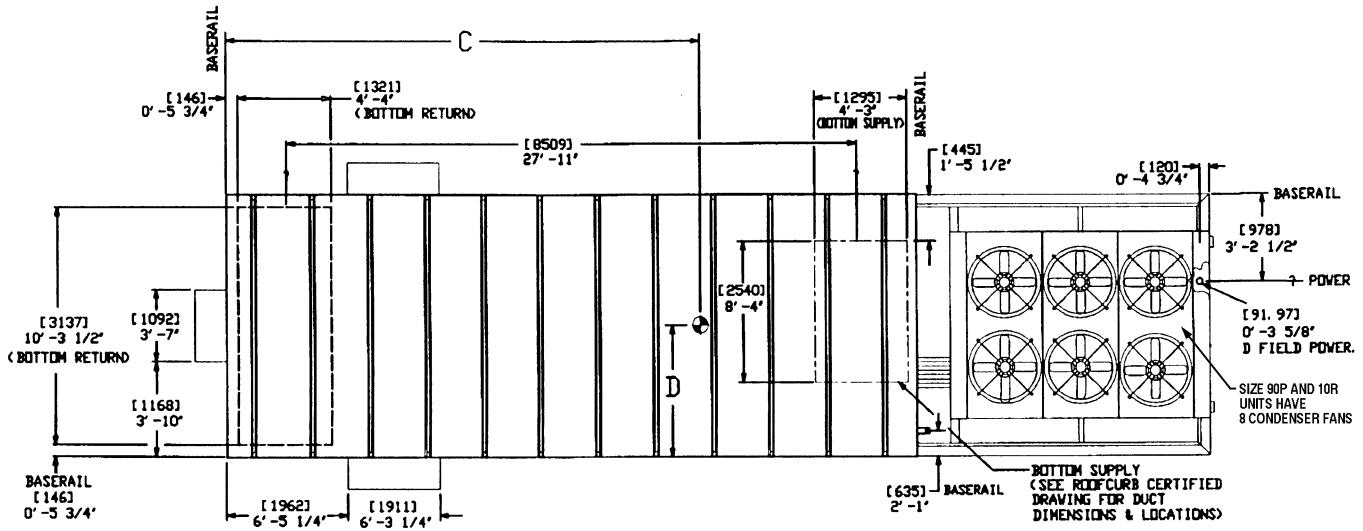


UNIT SIZE 48MPD,E	WEIGHT		A		B		C		D		E		F	
	lb	kg	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.
62L	16,810	7624	3505	11- 6	957	3-11/16	5909	19-4%	1203	3-11/8	13 011	42-8/4	14 256	46-9 1/4
70M	18,060	8190	3647	11-11 1/16	1165	3-9/8	6166	20-2 3/4	1264	4- 1 3/4	13 297	43-7 1/2	14 542	47-8 1/2

NOTES:

- Dimensions in [] are in millimeters.
- Center of gravity includes exhaust fan and high heat options. Unit weight does not include exhaust fan or high heat options.
- High heat add: 260 lb [118 kg]
Exhaust fan add: 1675 lb [761 kg] on 62L
1775 lb [807 kg] on 70M
- Unit clearances:
Top — Do not restrict condenser fans, control box end — 6'-0".
Sides — 6'-0" (except on return fan equipped units — 10'-0").
Economizer end — 6'-0" (except power exhaust units — 10'-0").
For smaller service and operational clearances, contact Application Engineering Department.
- Downshot ducts designed to be attached to accessory roof curb. If unit is mounted on dunnage, it is recommended the ducts be supported by cross braces as done on the accessory roof curb.

Fig. 3 — Base Unit Dimensions, 48MP62L, 70M



UNIT SIZE 48MPD,E	WEIGHT		A		B		C		D		E		F	
	lb	kg	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.
82N	22,660	10 295	3646	11-11 1/16	—	—	6734	22- 1 1/8	1753	5- 9	13 957	45-9 1/2	15 202	49-10 1/2
90P	24,660	11 203	1938	6- 4 5/16	2572	8-5 1/4	7283	23-10 1/4	1765	5-9 1/2	14 821	48-7 1/2	16 066	52- 8 1/2
10R	25,110	11 408	1938	6- 4 5/16	2572	8-5 1/4	7268	23-10 1/8	1759	5-9 1/4	14 821	48-7 1/2	16 066	52- 8 1/2

NOTES:

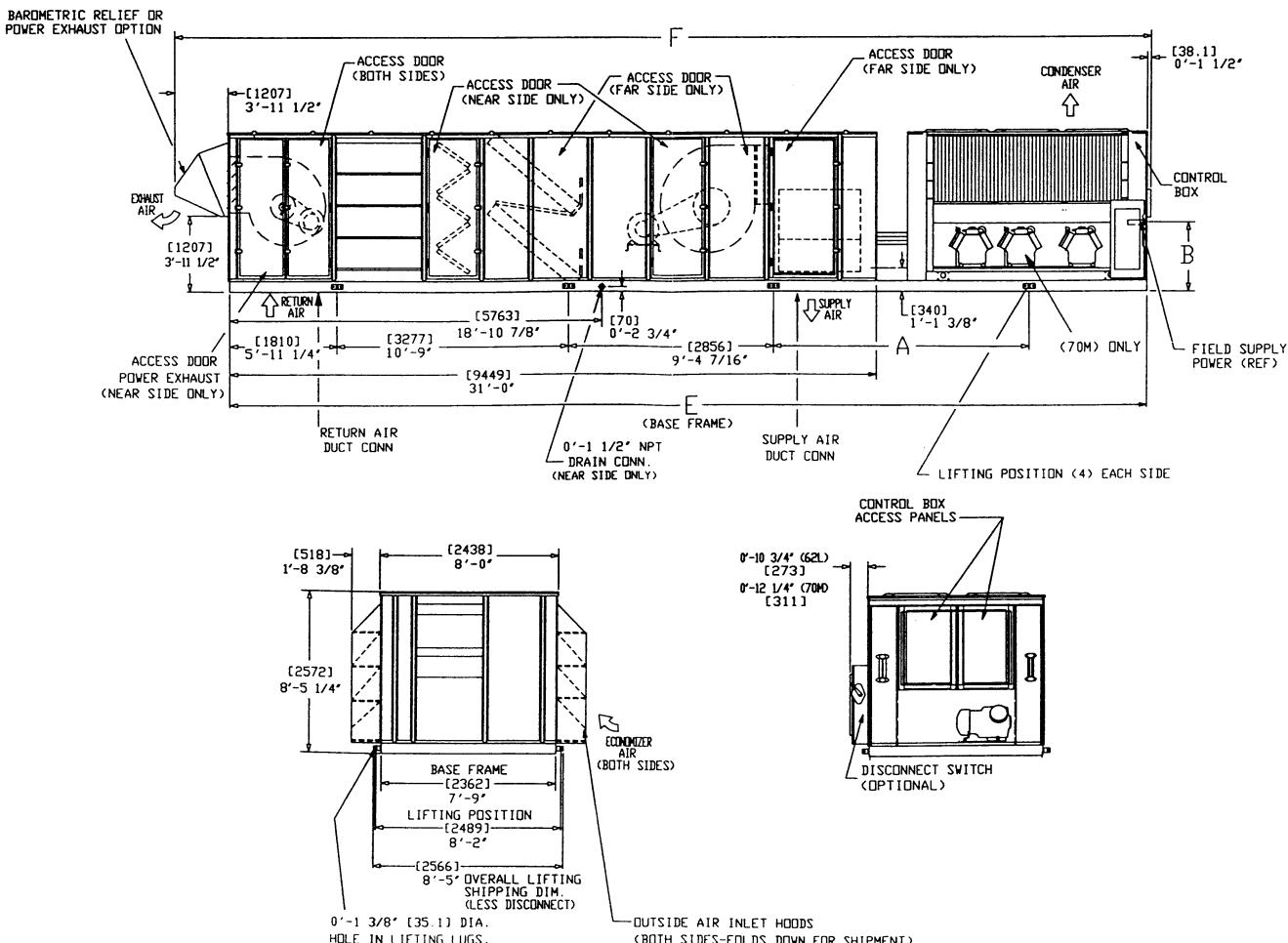
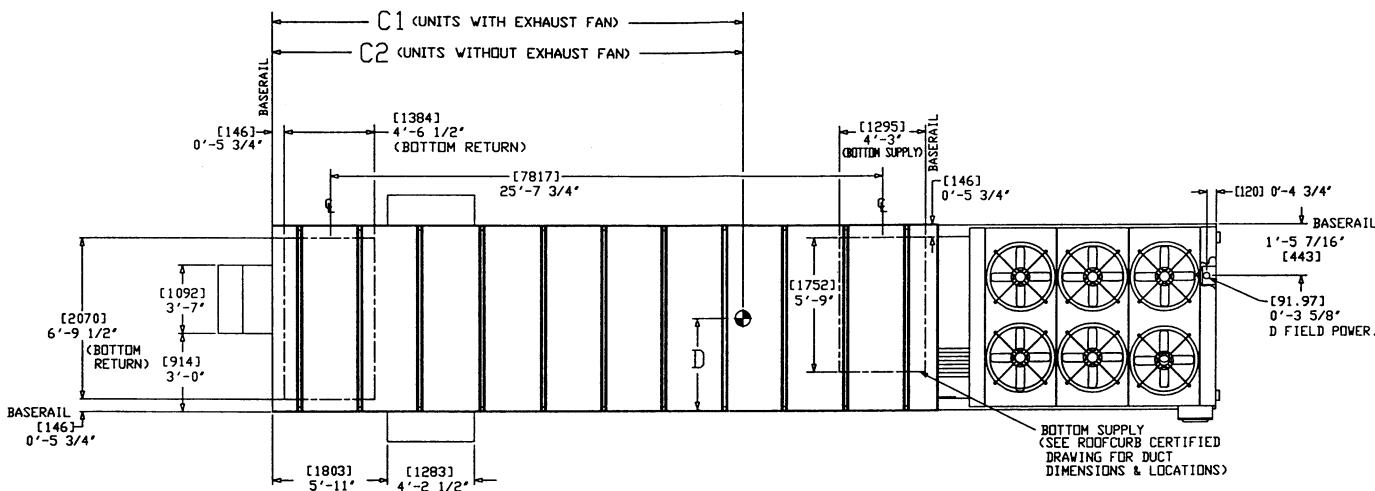
- Dimensions in [] are in millimeters.
- Center of gravity includes exhaust fan and high heat options. Unit weight does not include exhaust fan or high heat options.
- High heat add: 260 lb [118 kg]
Exhaust fan add: 2275 lb [1034 kg] on 82N
2400 lb [1090 kg] on 90P and 10R

4. Unit clearances:

- Top — Do not restrict condenser fans, control box end — 6'-0".
Sides — 6'-0" (except on return fan equipped units — 10'-0").
Economizer end — 6'-0" (except power exhaust units — 10'-0").
For smaller service and operational clearances, contact Carrier Application Engineering Department.
- Downshot ducts designed to be attached to accessory roof curb. If unit is mounted on Dunnage, it is recommended the ducts be supported by cross braces as done on the accessory roof curb.

Fig. 4 — Base Unit Dimensions, 48MP82N-10R

UNIT SIZE 50MP	WEIGHT (See Note 3)		A		B		C1 (See Note 2)		C2 (See Note 2)		D		E		F	
	lb	kg	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.
62L	16,550	7511	3505	11'- 6"	957	3'-11 ¹ / ₁₆ "	5880	19'-3 ¹ / ₂ "	6325	20'-9"	1203	3'-11 ³ / ₈ "	13 011	42'-8 ¹ / ₄ "	14 256	46'-9 ¹ / ₄ "
70M	17,800	8078	3647	11'-11 ¹⁵ / ₁₆ "	1165	3'-9 ⁷ / ₈ "	6166	20'-2 ³ / ₄ "	6649	21'-9 ³ / ₄ "	1264	4'-1 ³ / ₄ "	13 297	43'-7 ¹ / ₂ "	14 542	47'-8 ¹ / ₂ "

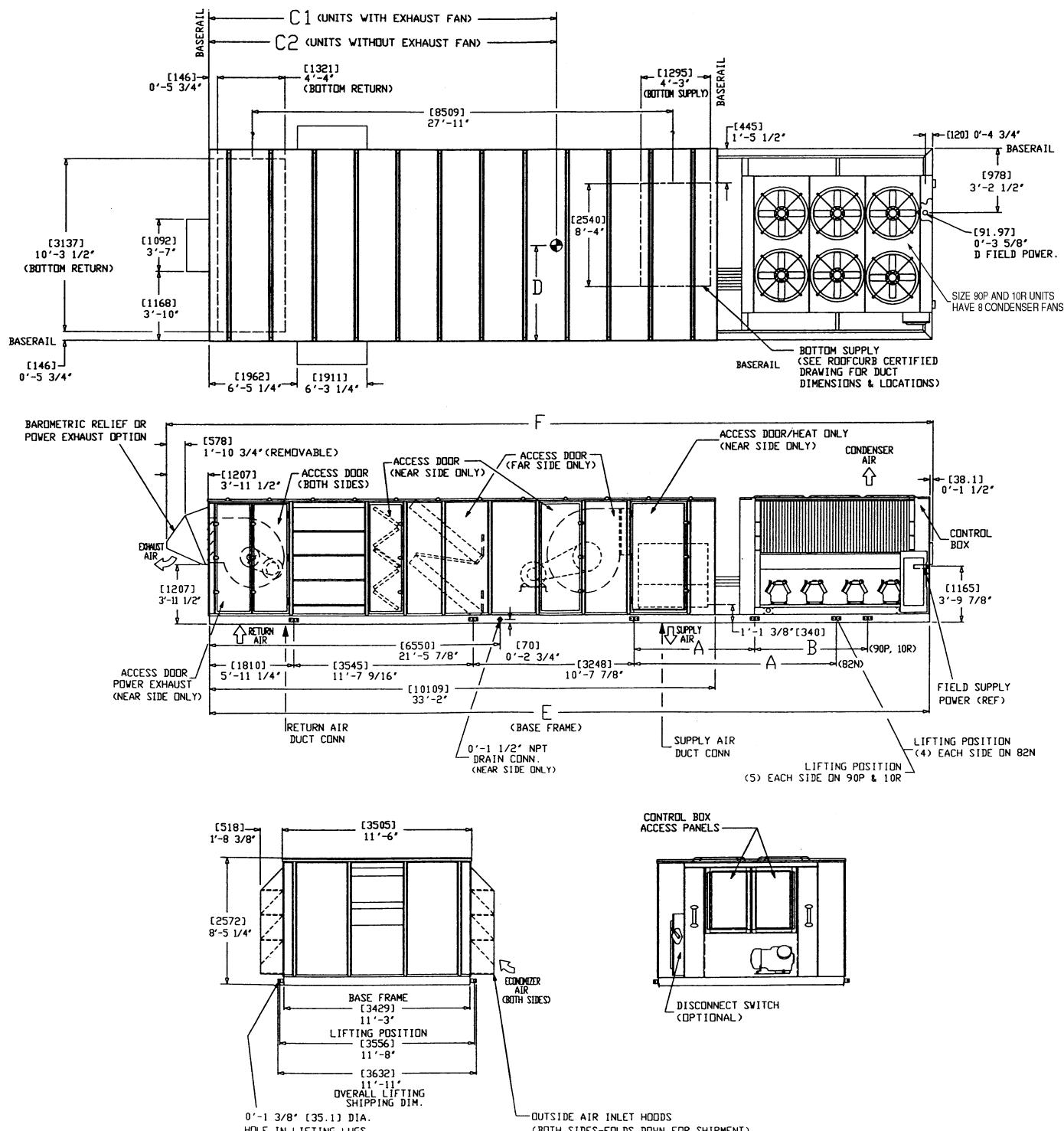


NOTES:

- Dimensions in [] are in millimeters.
- Center of gravity. Use appropriate column for units with or without exhaust fan option.
- Unit weight does not include exhaust fan option.
Exhaust fan add: 1675 lb [761 kg] on 62L
1775 lb [807 kg] on 70M
- Unit clearances:
Top — Do not restrict condenser fans.
- Sides — 6'-0"
Economizer End — 6'-0" (Except power exhaust units 10'-0").
Control Box End — 6'-0"
For smaller service and operational clearances, contact Carrier Application Engineering department.
- Downshot ducts designed to be attached to accessory roof curb. If unit is mounted on dunnage, it is recommended the ducts be supported by cross braces as done on the accessory roof curb.
- All lifting lugs must be used when rigging unit.

Fig. 5 — Base Unit Dimensions, 50MP62L and 70M

UNIT SIZE 50MP	WEIGHT (See Note 3)		A		B		C1 (See Note 2)		C2 (See Note 2)		D		E		F	
	lb	kg	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.	mm	ft-in.
82N	22,400	10 295	3646	11'-11 1/16"	—	—	6702	21'-11 7/8"	7180	23'-6 1/16"	1753	5'-9"	13 957	45'-9 1/2"	15 202	49'-10 1/2"
90P	24,750	11 375	1938	6'- 4 5/16"	2572	8'-5 1/4"	7383	23'-10 3/4"	7787	25'-6 9/16"	1765	5'-9 1/2"	14 821	48'-7 1/2"	16 066	52'-8 1/2"
10R	25,100	11 536	1938	6'- 4 5/16"	2572	8'-5 1/4"	7383	23'-10 1/8"	7793	25'-6 13 1/16"	1759	5'-9 1/4"	14 821	48'-7 1/2"	16 066	52'-8 1/2"



NOTES:

- Dimensions in [] are in millimeters.
- Center of gravity. Use appropriate column for units with or without exhaust fan option.
- Unit weight does not include exhaust fan option.
Exhaust fan add: 2275 lb [1034 kg] on 82N
2300 lb [1090 kg] on 90R and 10R
- Unit clearances:
Top — Do not restrict condenser fans.

Sides — 6'-0"

Economizer End — 6'-0" (Except power exhaust units 10'-0").

Control Box End — 6'-0"

For smaller service and operational clearances, contact Carrier Application Engineering department.

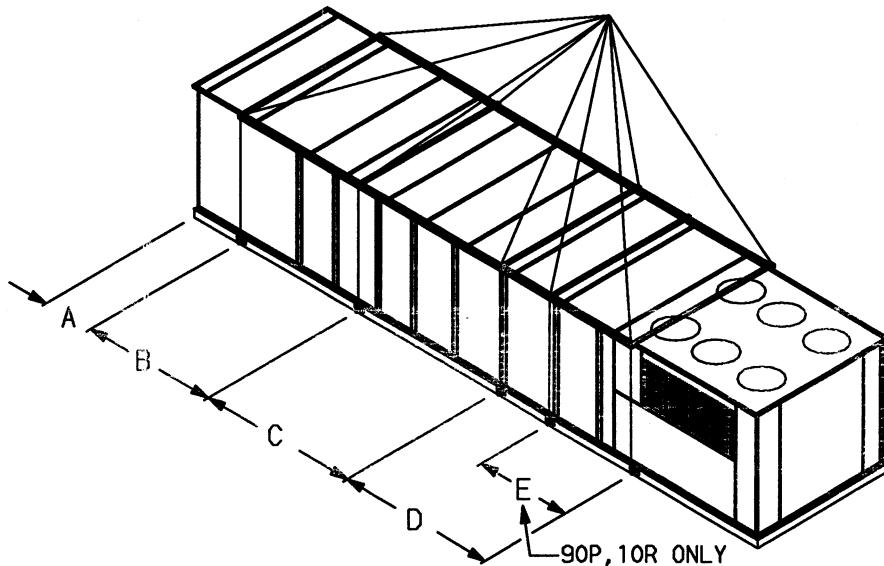
5. Downshot ducts designed to be attached to accessory roof curb. If unit is mounted on dunnage, it is recommended the ducts be supported by cross braces as done on the accessory roof curb.

6. All lifting lugs must be used when rigging unit.

Fig. 6 — Base Unit Dimensions, 50MP82N-10R

NOTICE TO RIGGERS

UNIT SIZE	WEIGHT						A		B		C		D		E	
	Unit 48MP		Unit 50MP		Exhaust Fan											
	lb	kg	lb	kg	lb	kg	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
62L	16,810	7 624	16,550	7 507	1675	760	71.25	1810	129.00	3277	112.44	2856	138.00	3505	N/A	N/A
70M	18,060	8 190	17,800	8 074	1775	805	71.25	1810	129.00	3277	112.44	2856	143.56	3646	N/A	N/A
82N	22,660	10 295	22,400	10 161	2275	1032	71.25	1810	139.56	3545	127.87	3248	143.56	3646	N/A	N/A
90P	24,660	11 203	24,750	11 227	2400	1089	71.25	1810	139.56	3545	127.87	3248	177.56	4510	101.25	2572
10R	25,110	11 408	25,100	11 385	2400	1089	71.25	1810	139.56	3545	127.87	3248	177.56	4510	101.25	2572

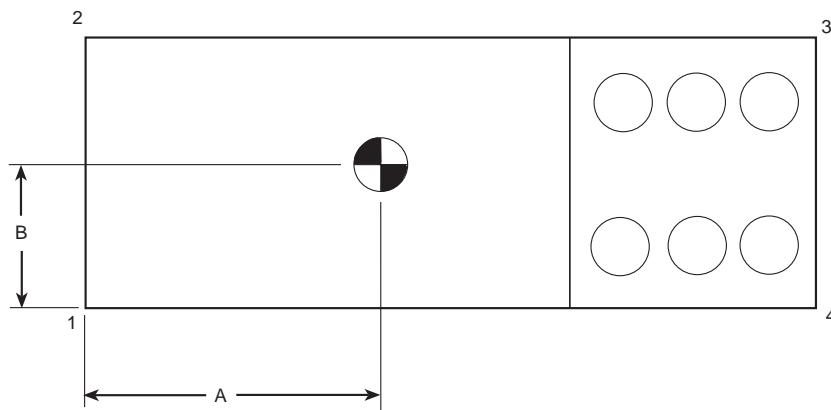


NOTE: All lifting lugs must be used when rigging with eight or ten cables and spread with four or five 95 in. (2413 mm) and two "B + C + D" long suitable spreader bars. Unit weight does not include exhaust fan option.

CAUTION

- 1. All panels must be in place when rigging.
- 2. Unit is not designed for handling by fork truck.

Fig. 7 — Rigging Label



UNIT 48MP	CORNER WEIGHT (lb)				DIMENSIONS (ft-in.)	
	1	2	3	4	A	B
62L	5095	5000	4339	4051	19- 4 5/8	3-11 3/8
70M	5337	5338	5290	3969	20- 2 3/4	4- 1 3/4
82N	6614	6326	6444	5651	22- 1 1/8	5- 9
90P	7156	6789	7330	6226	23-10 3/4	5- 9 1/2
10R	7174	6897	7345	6254	23-10 1/8	5- 9 1/4

UNIT 50MP	CORNER WEIGHT (lb)				DIMENSIONS (ft-in.)	
	1	2	3	4	A	B
62L	4237	3967	5038	4933	19- 3 1/2	3-11 3/8
70M	5258	3955	5185	5167	20- 2 3/4	4- 1 3/4
82N	6351	5571	6574	6279	21-11 7/8	5- 9
90P	7211	6132	7045	6761	23-10 3/4	5- 9 1/2
10R	7288	6196	7195	6820	23-10 1/8	5- 9 1/4

Fig. 8 — Unit Center of Gravity and Corner Weights

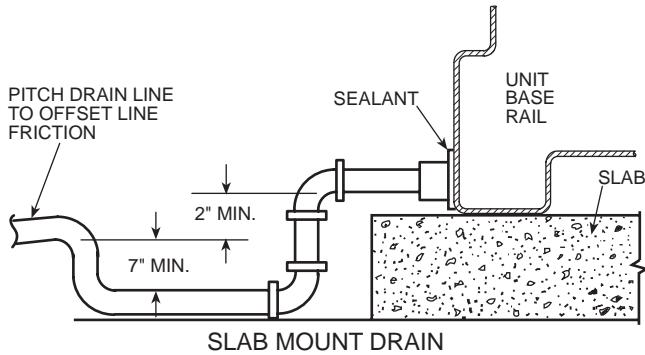


Fig. 9 — Condensate Drain Piping Details

Make Electrical Connections

POWER SUPPLY — Electrical characteristics of available power supply must agree with unit nameplate rating. Supply voltage must be within the limits shown in Table 5.

Field Wire Routing — Field wiring is brought into the unit through the bottom of the control box.

A 3 5/8-in. hole for field power wiring and a 7/8-in. hole for 24-v control wiring are provided in the bottom of the control box. Field-supplied couplings must be used when routing wiring into the control box.

Field Electrical Connections

IMPORTANT: The 48/50MP units generate, use, and can radiate radio frequency energy. If units are not installed and used in accordance with these instructions, they may cause radio interference. They have been tested and found to comply with limits of a Class A computing device as defined by FCC (Federal Communications Commission) regulations, Subpart J of Part 15, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

POWER WIRING — Units are factory wired for 460-v as shown on the unit nameplate. The main terminal block is suitable for use with aluminum or copper wires. Maximum wire size is 500 MCM.

Branch circuit for power supply to unit must be protected against ground fault or short circuit. Provide an overcurrent protection device in the branch circuit. The MOCP (Maximum Overcurrent Protection) value for this device is shown on unit informative data plate.

When installing units, provide and install a unit safety disconnect per NEC of adequate size. Refer to Electrical Data tables for disconnect sizing. Disconnect may incorporate branch circuit fusing (if local or national codes permit) but combination disconnect fuse is not required. Disconnect must be able to be locked OFF.

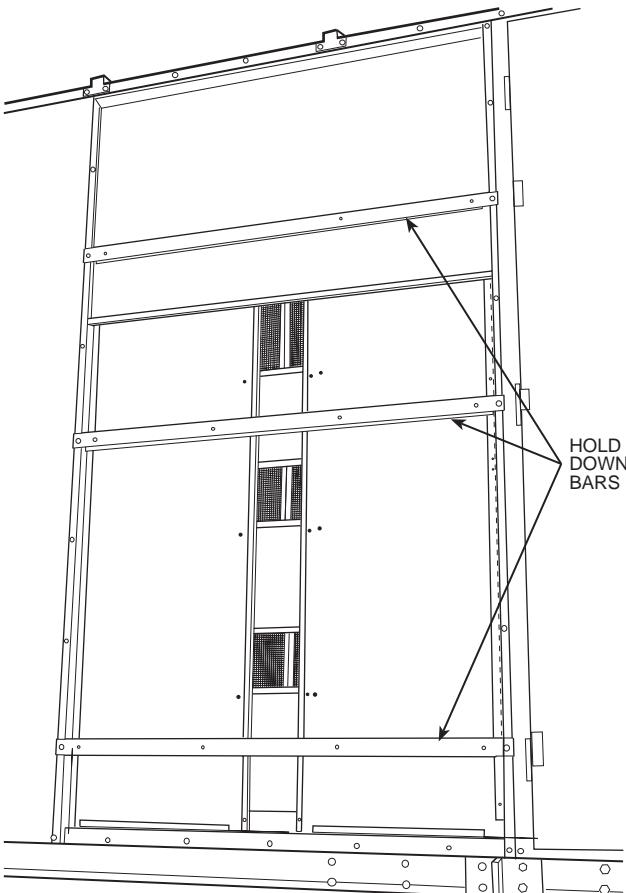


Fig. 10 — Outdoor Air Hoods Shipping Position

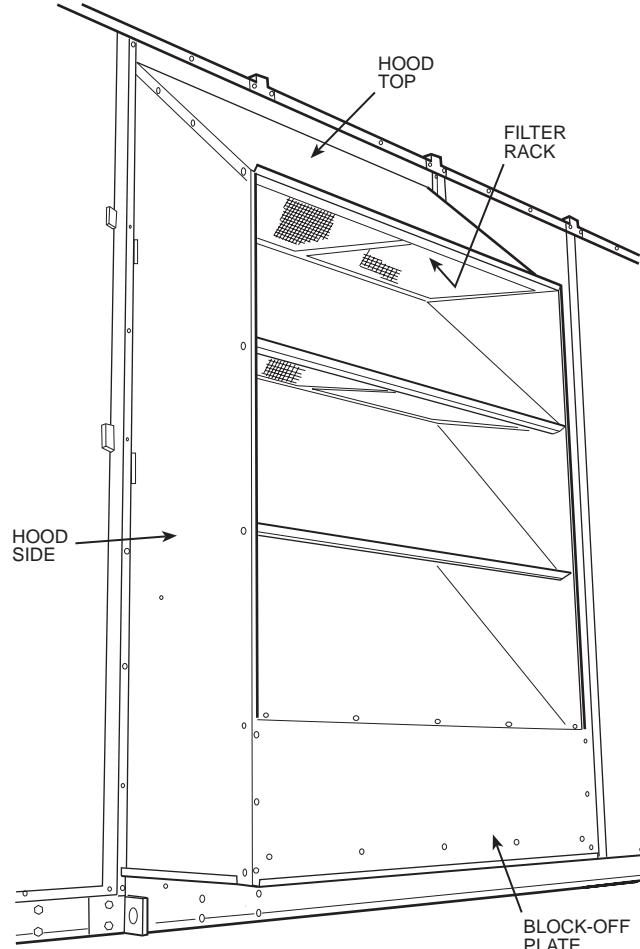


Fig. 11 — Outdoor Air Hoods Installed

Disconnect must be located within sight of the unit and readily accessible from the unit in compliance with NEC Article 440-14.

All field wiring must comply with NEC and all local codes. Size wire based on MCA (Minimum Circuit Amps) value shown on the unit informative plate. See Fig. 12 for power wiring connections to the unit power terminal block and equipment ground.

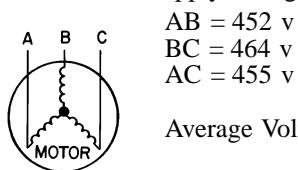
Operating voltage to the compressor must be within the voltage range indicated on the unit nameplate. Voltages between phases must be balanced within 2%, and the current must be balanced within 10%. See Table 5 for unit electrical data.

Use the following formula to determine the percent voltage imbalance.

% Voltage Imbalance

$$= 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

EXAMPLE: Supply voltage is 460-3-60.



$$\begin{aligned} \text{Average Voltage} &= \frac{452 + 464 + 455}{3} \\ &= \frac{1371}{3} \\ &= 457 \end{aligned}$$

Determine maximum deviation from average voltage:

$$\begin{aligned} (\text{AB}) 457 - 452 &= 5 \text{ v} \\ (\text{BC}) 464 - 457 &= 7 \text{ v} \\ (\text{AC}) 457 - 455 &= 2 \text{ v} \end{aligned}$$

Maximum deviation is 7 v.

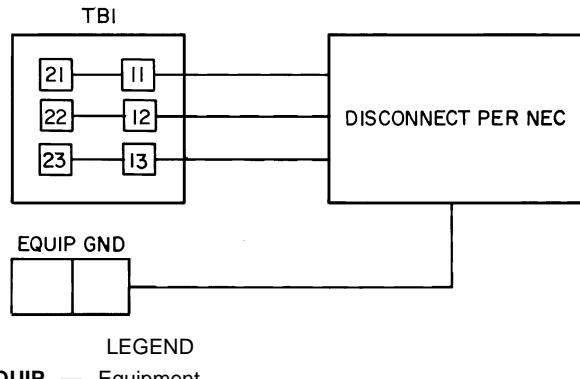
Determine percent voltage imbalance:

$$\begin{aligned} \% \text{ Voltage Imbalance} &= 100 \times \frac{7}{457} \\ &= 1.53\% \end{aligned}$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact local utility immediately.

Unit failure as a result of operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components.



LEGEND

EQUIP	— Equipment
GND	— Ground
NEC	— National Electrical Code
TB	— Terminal Block

Fig. 12 — Field Power Wiring Connections

Table 5 — Electrical Data

UNIT 48MP/ 50MP	VOLTAGE 3 Ph, 60 Hz	VOLTAGE RANGE		COMP NO. A1		COMP NO. A2		COMP NO. B1		COMP NO. B2		CONDENSER FAN MOTORS			EVAPORATOR FAN MOTOR		POWER EXHAUST FAN MOTOR		MCA	MOCP		
		Min	Max	RLA	LRA	RLA	LRA	RLA	LRA	RLA	LRA	Qty	FLA	Hp	FLA	Hp	FLA	Hp				
62L	460	414	508	65.4	345	—	—	65.4	345	—	—	6	3.3	1	40	30	—	—	207.0	250		
																	11	7.5	218.0	250		
																	40	30	247.0	300		
																	—	—	219.0	250		
																	11	7.5	230.0	250		
																	40	30	259.0	300		
																	—	—	232.0	250		
																	65	50	11	7.5	243.0	300
																	40	30	272.0	300		
																	—	—	235.0	300		
70M	460	414	508	46.8	253	34.6	173	65.4	345	—	—	6	3.3	1	52	40	—	—	246.0	300		
																	11	7.5	287.0	350		
																	—	—	248.0	300		
																	65	50	11	7.5	259.0	300
																	52	40	52	40	300.0	350
																	—	—	262.9	300		
																	77	60	11	7.5	273.9	350
																	52	40	52	40	314.9	350
																	—	—	250.2	300		
																	11	7.5	261.2	300		
82N	460	414	508	43.6	223	34.6	173	43.6	223	43.6	223	6	3.3	1	52	40	—	—	288.5	350		
																	14	10	302.5	350		
																	65	50	353.5	350		
																	—	—	303.5	350		
																	77	60	14	10	317.5	350
																	65	50	65	50	368.5	400
																	—	—	327.5	400		
																	14	10	341.5	400		
																	65	50	65	50	392.2	450
																	—	—	307.2	350		
90P	460	414	508	43.6	223	46.8	253	43.6	223	46.8	253	8	3.3	1	65	50	—	—	322.1	350		
																	77	60	14	15	336.1	400
																	77	60	77	60	399.1	450
																	—	—	345.8	400		
																	14	15	14	15	359.8	450
																	77	60	77	60	422.8	500
																	—	—	322.1	350		
																	—	—	303.5	350		
																	—	—	317.5	350		
																	96	75	14	15	341.5	400

LEGEND

- COMP** — Compressor
- FLA** — Full Load Amps
- Hp** — Nominal Horsepower
- LRA** — Locked Rotor Amps
- MCA** — Minimum Circuit Amps (for wire sizing)
- MOCP** — Maximum Overcurrent Protection
- RLA** — Rated Load Amps

Control Wiring — See Fig. 13 for sensor wiring connections to main and auxiliary control boxes. The recommended types of control wiring for 48/50MP unit devices are shown in Table 6.

Table 6 — Recommended Sensor and Device Non-Shielded Cable

MANUFACTURER	PART NO.	
	Regular Wiring	Plenum Wiring
Alpha	1895	—
American	A21451	A48301
Belden	8205	884421
Columbia	D6451	—
Manhattan	M13402	M64430
Quabik	6130	—

SENSORS — Sensors should be wired using single twisted pairs of 20 AWG (American Wire Gage) conductor cable rated for the application, except for the T56 accessory sensor which requires 3-conductor cable.

NOTE: Humidity and CO₂ sensors must be powered from isolated 24-v power supplies.

HUMIDITY CONTROL AND HOT WATER AND STEAM VALVES — These devices require 20 AWG twisted pair conductor cables rated for the application for the 4 to 20 mA signal.

SPACE TEMPERATURE SENSOR (T55) — The space temperature sensor (P/N CEC0121448-01) is shipped standard with every unit, and is located in the main control box. Space temperature sensor wires are to be connected to terminals in the unit main control box. The space temperature sensor includes a terminal block (TB1), a jumper between pins E2 and E3, and an RJ11 female connector. The RJ11 connector is used to tap into the Carrier Comfort Network (CCN) at the sensor. See RJ11 Plug Wiring section on page 24 to connect the RJ11 connector to the CCN. A 3-lead cable must run from the RJ11 connector to the unit for communication through the sensor.

⚠ CAUTION

Jumper **MUST** be in place between pins E2 and E3 or inaccurate readings could result.

To connect the space temperature sensor (Fig. 13):

1. Connect 1 wire of the twisted pair to terminal T1 (T55) and connect the other wire to terminal T2 on terminal block 1 (TB1) located on the cover of the space temperature sensor using a 20 AWG twisted pair conductor cable rated for the application.
2. Connect the other ends of the wires to terminals 1 and 2 on TB3 located in the unit main control box.

NOTE: This sensor should be installed for all applications. For VAV (variable air volume) applications, it is used to control heating and cooling during unoccupied periods. For DAV (digital air volume) applications, it is used to maintain control of the space during linkage failures with the TSM (terminal system manager).

NOTE: Either the T55 or T56 sensor must be connected for CV (constant volume) applications to function properly.

SPACE TEMPERATURE SENSOR (T56) (CV Applications Only) — The space temperature sensor (P/N CEC0121503-01) wires are to be connected to terminals in the unit main control box. The space temperature sensor includes a terminal block (TB1), a jumper between

pins E2 and E3, and an RJ11 female connector. The RJ11 connector is used to tap into the CCN at the sensor. See RJ11 Plug Wiring section on page 24 to connect the RJ11 connector to the CCN.

⚠ CAUTION

Jumper **MUST** be in place between pins E2 and E3 or inaccurate readings could result.

To connect the space temperature sensor (Fig. 13):

1. Connect one wire of the 3-conductor cable to terminal TH, one wire to terminal COM, and the other wire to terminal SW on terminal block 1 (TB1) located on the cover of the space temperature sensor using a 20 AWG twisted 3-conductor cable rated for the application.
2. Connect the other ends of the wires to terminals 1, 2, and 3 on TB3 located in the unit main control box. The wire from terminal SW **MUST** be connected to terminal 3.

NOTE: Either the T55 or the T56 sensor must be connected for CV applications to function properly.

SPACE TEMPERATURE AVERAGING — Applications that require averaging using multiple space temperature sensors can be satisfied using either 4 or 9 sensors as shown in Fig. 14.

NOTE: Only Carrier sensors may be used for standard T55 space averaging. Sensors must be used in multiples of 1, 4, and 9 only, with total sensors wiring not to exceed 1000 ft. However, space temperature reset can be accomplished with only one sensor.

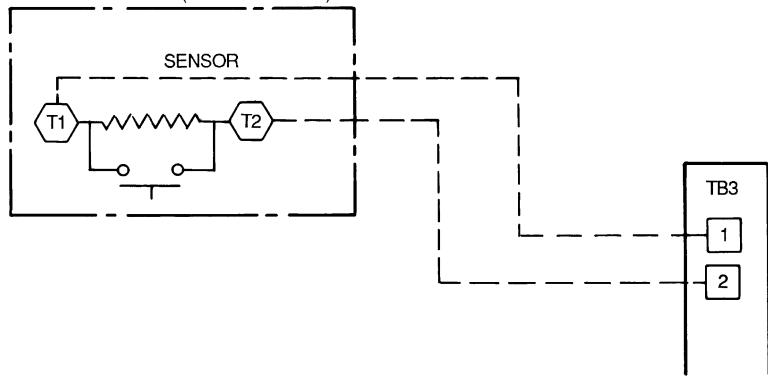
NOTE: Do not use T56 sensors for space temperature averaging because the 5 degree offset function will not work in a multiple sensor application.

HEAT INTERLOCK RELAY (VAV Units Only — Not Necessary For Digital Air Volume Applications) — Variable air volume (VAV) units using optimal start (morning warm-up) and/or occupied heating require that room terminals be controlled to the fully open position when the unit goes into heating mode. The HIR (Heat Interlock Relay) function is provided for this control on DSIO no. 2, channel 60. When the unit goes into heating mode, the HIR is energized to provide switch closure or opening (depending on how the field-supplied power source is set up) to open the room terminals. The field connections for the HIR are: Normally Closed, terminals 8 and 10 on TB3; and Normally Open, terminals 8 and 9 on TB3. See Fig. 15.

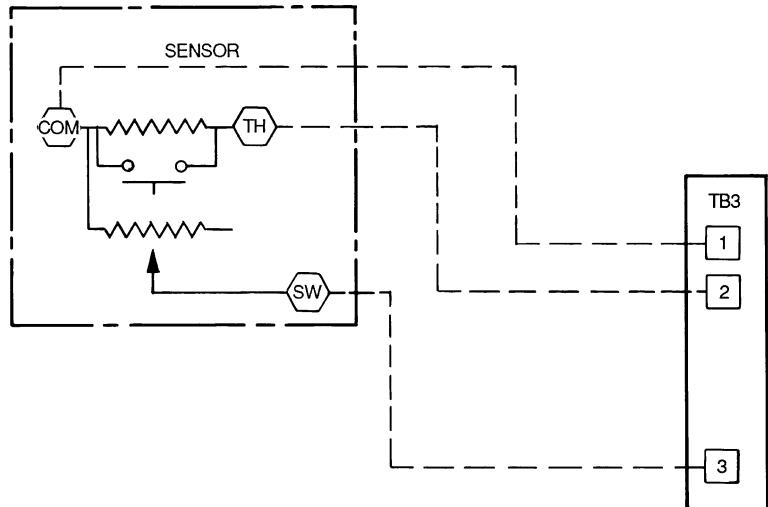
OPTION AND ACCESSORY CONTROL WIRING — The 48/50MP units may be used in applications with additional control features, options, or accessories. Refer to the Controls and Troubleshooting manual for more information concerning installation and configuration of options and accessories. Figures 15 to 29 contain wiring information on the following features:

- heat interlock relay (Fig. 15)
- differential enthalpy sensor (Fig. 16)
- remote start (Fig. 17)
- accessory humidity control (Fig. 18)
- fire/smoke control (Fig. 19)
- indoor air quality (Fig. 20)
- outdoor airflow control (Fig. 21)
- timed discrete output (Fig. 22)
- humidifier (Fig. 23)
- hydronic heating (Fig. 24)
- freezestat (Fig. 25)
- remote supply air temperature/space temperature offset (Fig. 26)
- transducer/thermistor (Fig. 27)
- CCN Building Supervisor (Fig. 28)
- variable frequency drive (VFD) (Fig. 29)

STANDARD T55 (CEC0121448-01)



ACCESSORY T56* (CEC0121503-01)



LEGEND

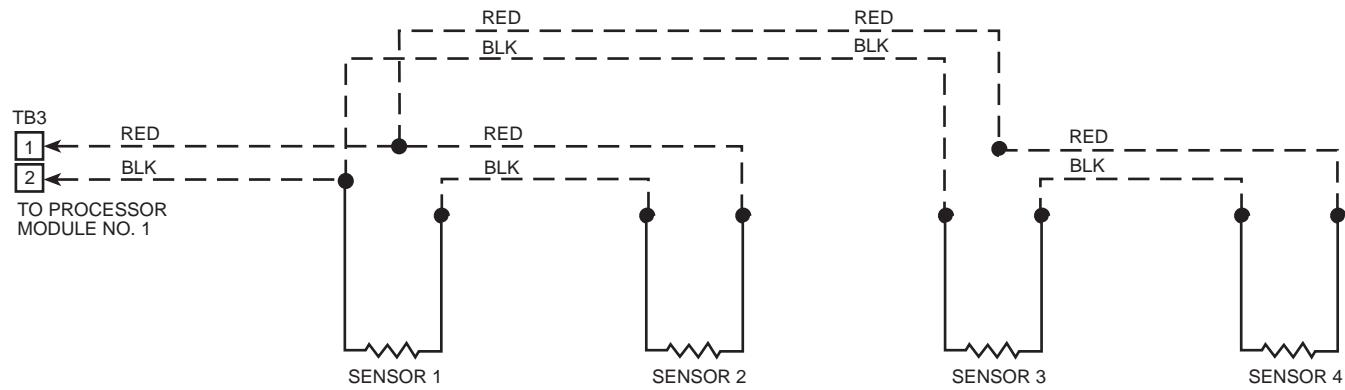
COM	— Common
SW	— Switch
T	— Terminal
TB	— Terminal Block
TH	— Thermostat Heating

— Accessory

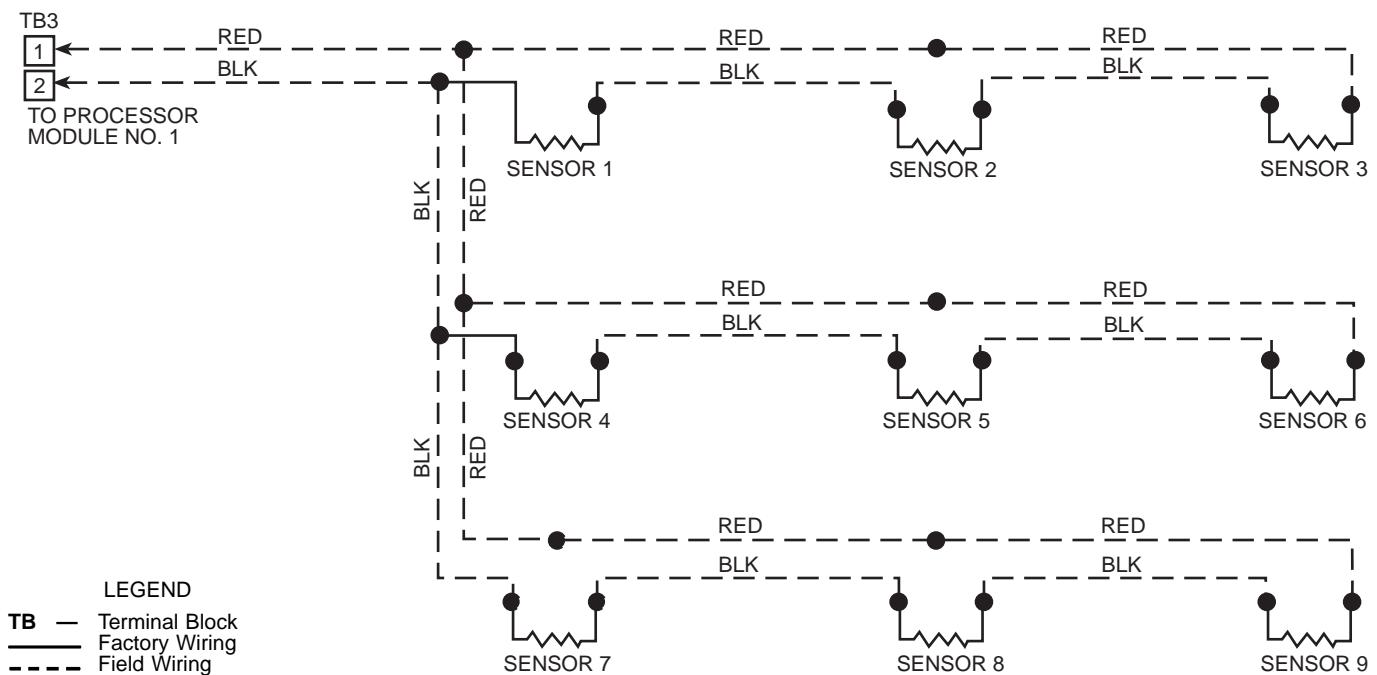
- - - Field Wiring

*Constant volume applications only.

Fig. 13 — Space Temperature Sensor Wiring

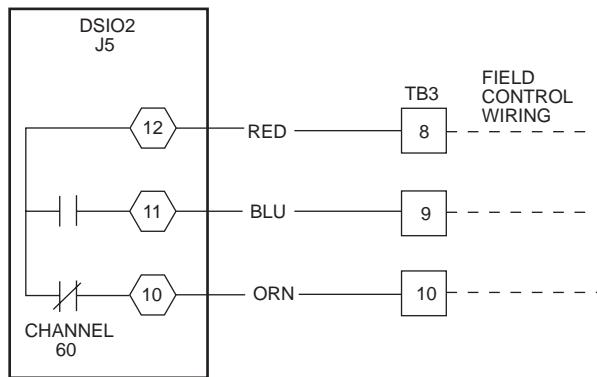


SPACE TEMPERATURE AVERAGING — 4 SENSOR APPLICATION



SPACE TEMPERATURE AVERAGING — 9 SENSOR APPLICATION

Fig. 14 — Space Temperature Sensor Averaging

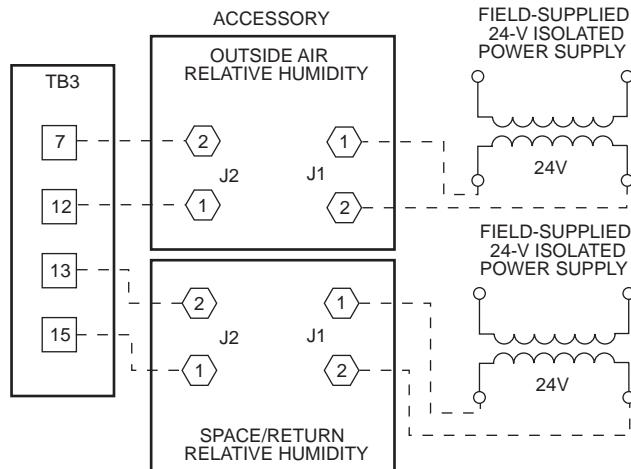


LEGEND

TB — Terminal Block
--- Field Wiring

○ Component Terminal
□ Terminal Block Terminal

Fig. 15 — Heat Interlock Relay



LEGEND

TB — Terminal Block
--- Field Wiring

○ Component Terminal
□ Terminal Block Terminal

Fig. 18 — Accessory Humidity Control

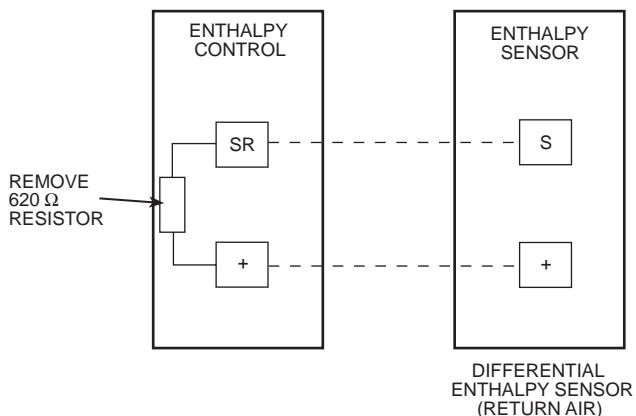
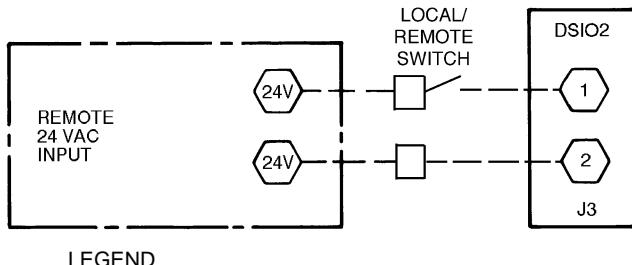


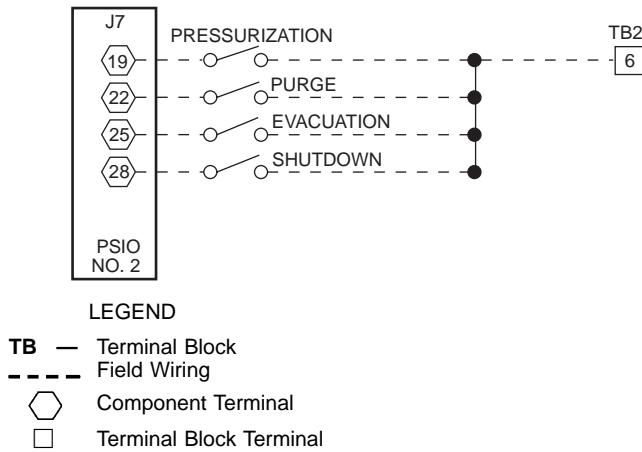
Fig. 16 — Differential Enthalpy Sensor



LEGEND

DSIO — Relay Module

Fig. 17 — Remote Start



LEGEND

TB — Terminal Block
--- Field Wiring

○ Component Terminal
□ Terminal Block Terminal

Fig. 19 — Fire/Smoke Control

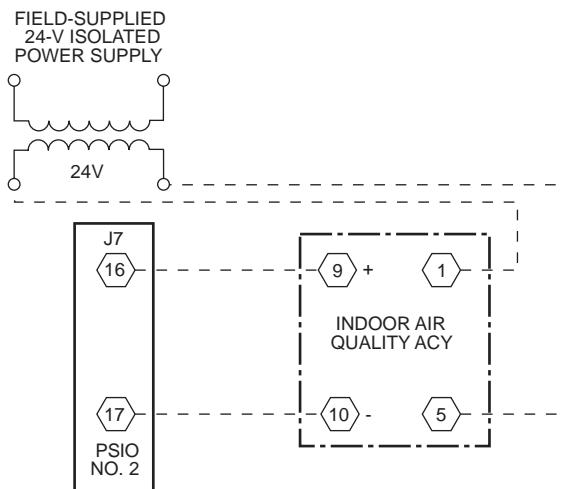


Fig. 20 — Indoor Air Quality

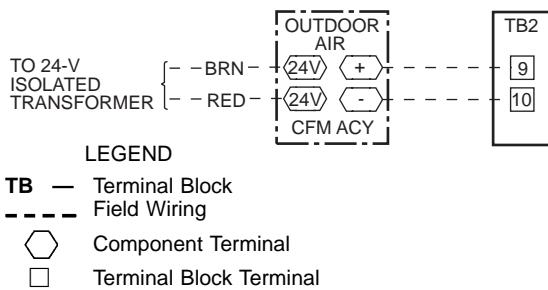


Fig. 21 — Outdoor Airflow Control

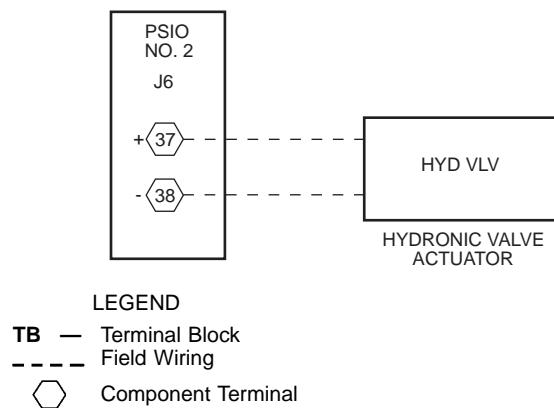


Fig. 24 — Hydronic Heating

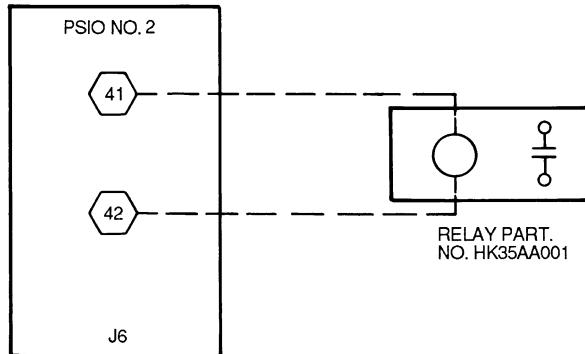
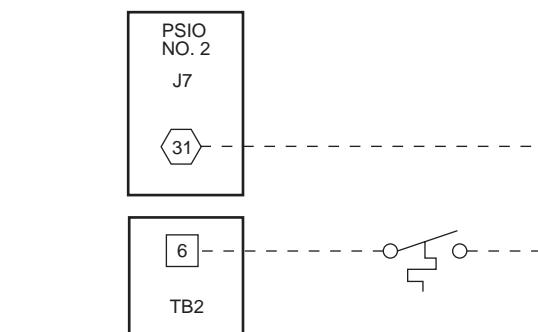


Fig. 22 — Timed Discrete Output



LEGEND

- TB** — Terminal Block
- Field Wiring
- Component Terminal
- Terminal Block Terminal

Fig. 25 — Freezestat

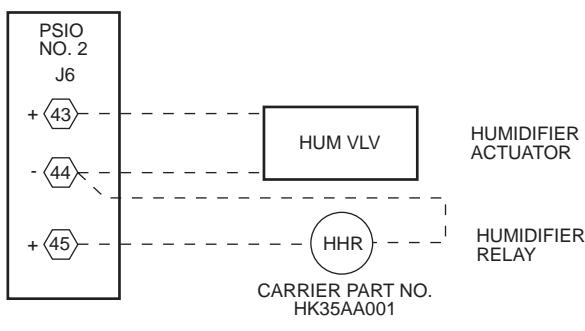
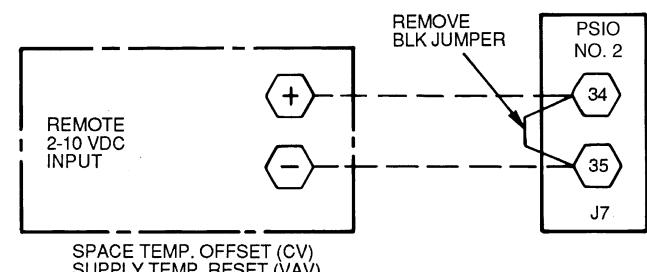


Fig. 23 — Humidifier



**Fig. 26 — Remote Supply Air Temperature
Reset/Space Temperature Offset**

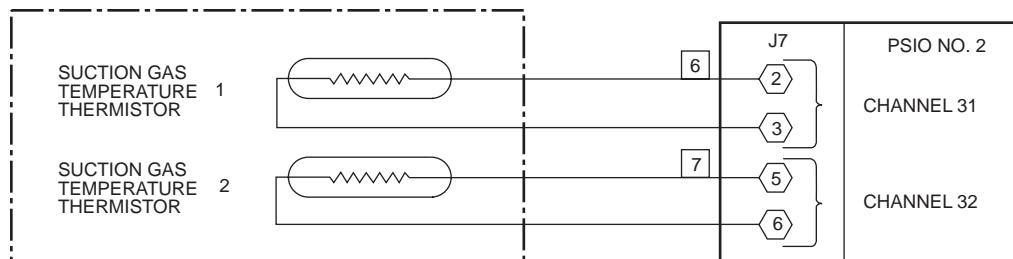
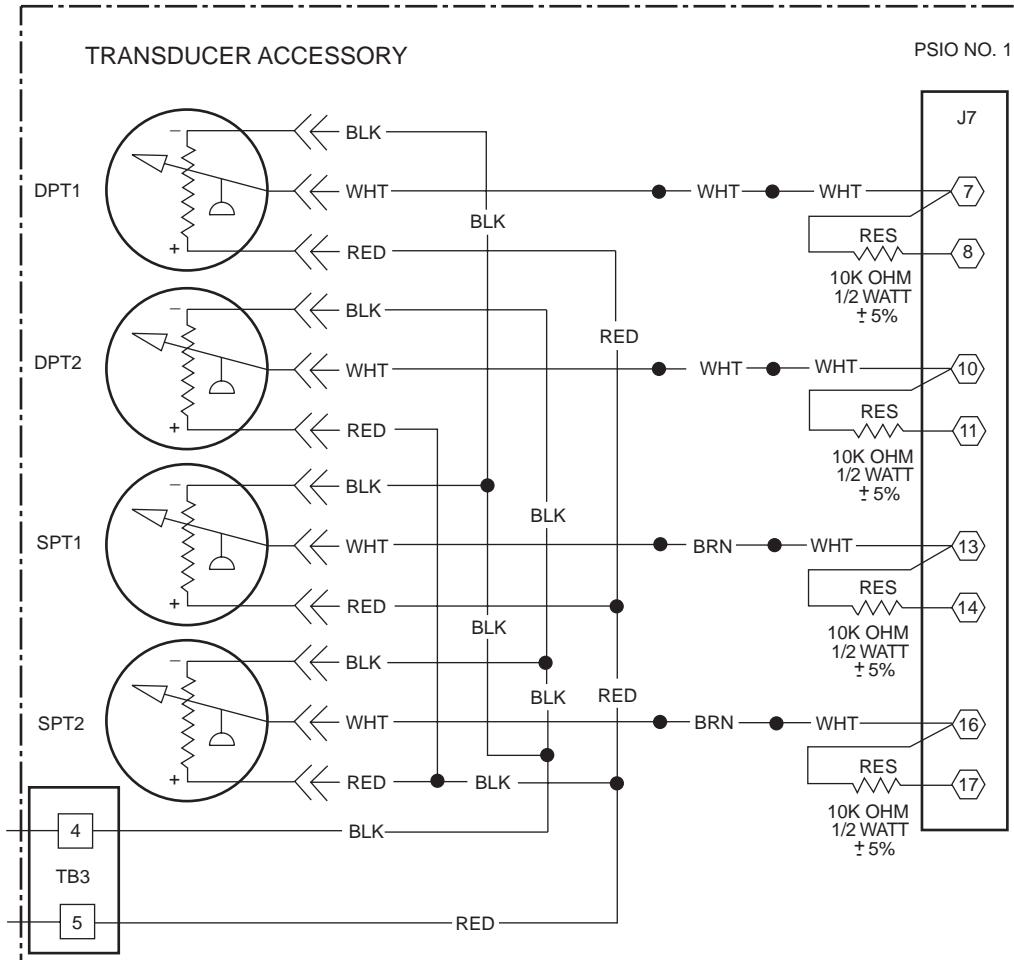


Fig. 27 — Transducer/Termistor

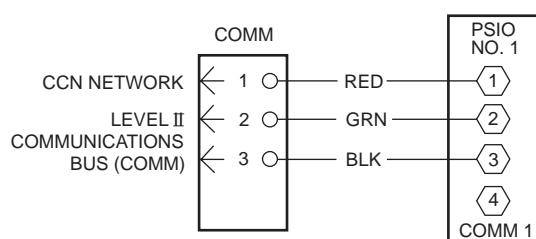


Fig. 28 — CCN Building Supervisor

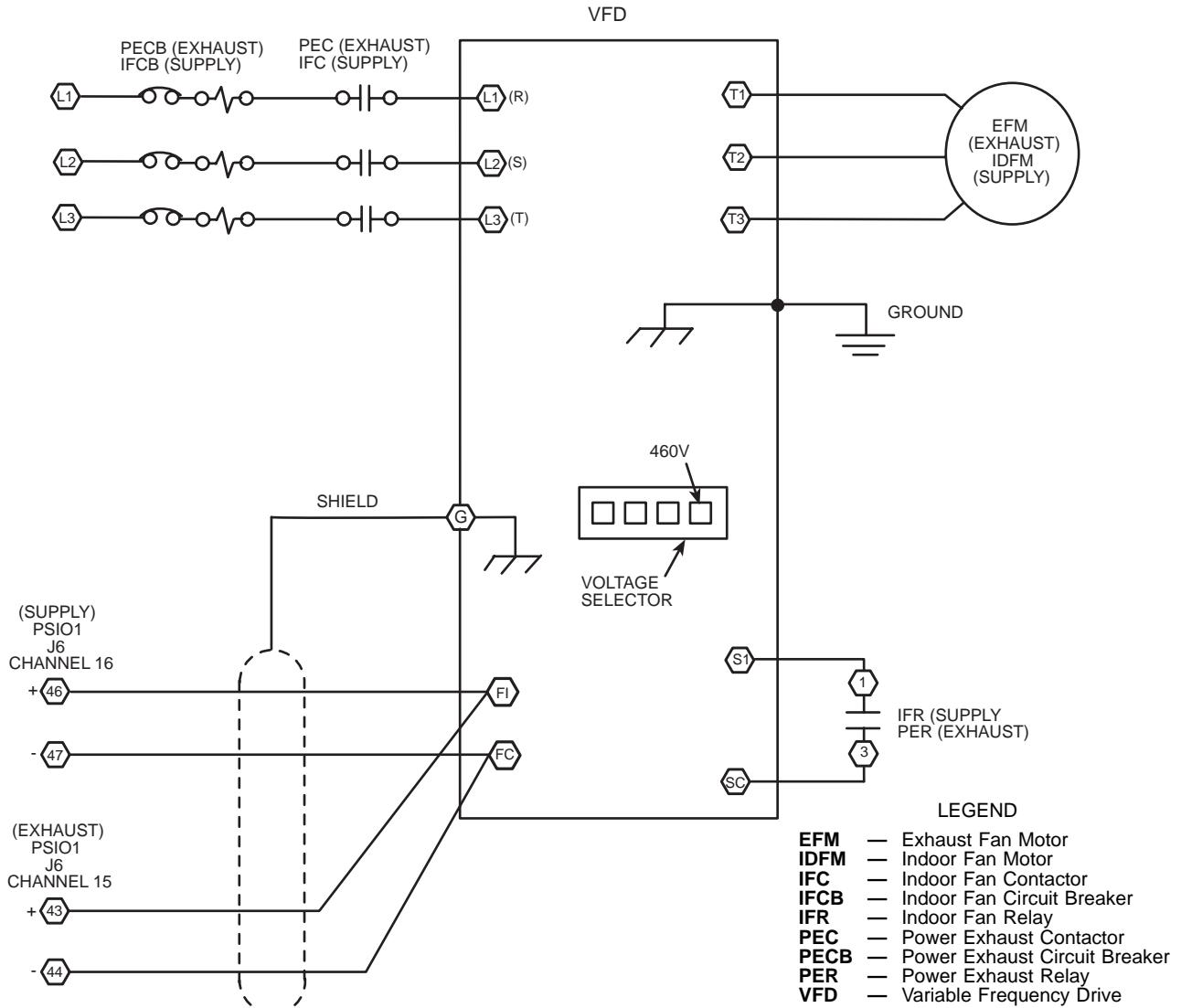


Fig. 29 — Optional VFD — Wiring Connections

Carrier Comfort Network Interface — The 48/50MP units can be connected to the CCN if desired. The communication bus wiring is supplied and installed in the field. It consists of shielded, 3-conductor cable with drain wire.

The system elements are connected to the communication bus in a daisy chain arrangement. The positive pin of each system element communication connector must be wired to the positive pins of the system element on either side of it, the negative pins must be wired to the negative pins, and the signal pins must be wired to signal ground pins. Wiring connections for CCN should be made at the 4-pin plug (COMM) located at the bottom right side of the fuse bracket in the main control box. Consult CCN Contractor's Manual for further information.

NOTE: Conductors and drain wire must be 20 AWG minimum stranded, tinned copper. Individual conductors must be insulated with PVC, PVC/nylon, vinyl, Teflon, or polyethylene. An aluminum/polyester 100% foil shield and an

outer jacket of PVC, PVC/nylon, chrome vinyl, or Teflon with a minimum operating temperature range of -20 C to 60 C is required. See Table 7 for cables that meet the requirements.

Table 7 — CCN Connection Approved Shielded Cables

MANUFACTURER	CABLE PART NO.
Alpha	2413 or 5463
American	A22503
Belden	8772
Columbia	02525

IMPORTANT: When connecting the CCN communication bus to a system element, use a color coding system for the entire network to simplify installation and checkout.

The following color code is recommended:

SIGNAL TYPE	CCN BUS CONDUCTOR INSULATION COLOR	COMM1 PLUG PIN NO.
+	RED	1
GROUND	WHITE	2
-	BLACK	3

NOTE: If a cable with a different color scheme is selected, a similar color code should be adopted for the entire network.

At each system element, the shields of its communication bus cables must be tied together. If the communication bus is entirely within one building, the resulting continuous shield must be connected to a ground at one point only. If the communication bus cable exits from one building and enters another, the shields must be connected to grounds at the lightning suppressor in each building where the cable enters or exits the building (one point per building only).

To connect the unit to the network:

1. Turn off power to the control box.
2. Cut the CCN wire and strip the ends of the red (+), white (ground) and black (-) conductors. (If a different network color scheme is used, substitute appropriate colors.)
3. Remove the 4-pin female plug from the fuse and control circuit breaker bracket in the main control box, and connect the wires as follows:
 - a. Insert and secure the red (+) wire to terminal 1 of the 4-pin plug.
 - b. Insert and secure the white (ground) wire to terminal 2 of the 4-pin plug.
 - c. Insert and secure the black (-) wire to terminal 3 of the 4-pin plug.
4. Insert the plug into the existing 4-pin mating connector on the fuse or control circuit breaker bracket in the main control box.

IMPORTANT: A shorted CCN bus cable will prevent some routines from running and may prevent unit from starting. If abnormal conditions occur, unplug the connector. If conditions return to normal, check CCN connector, and run new cable if necessary. A short in one section of the bus can cause problems with all system elements on the bus.

RJ11 PLUG WIRING — Units on the CCN can be monitored from the space at the sensor through the RJ11 connector, if desired. To wire the RJ11 connector into the CCN (Fig. 30):

IMPORTANT: The cable selected for the RJ11 connector wiring MUST be identical to the CCN communication bus wire used for the entire network. Refer to Table 7 for acceptable wiring.

1. Cut the CCN wire and strip ends of the red (+), white (ground), and black (-) conductors. (If another wire color scheme is used, strip ends of appropriate wires.)
2. Insert and secure the red (+) wire to pin J2 (T-55) or CCN + (T-56) of the space temperature sensor terminal block (TB1).
3. Insert and secure the white (ground) wire to pin J3 (T-55) or CCN GND (T-56) of the space temperature sensor TB1.
4. Insert and secure the black (-) wire to pin J5 (T-55) or CCN - (T-56) of the space temperature sensor TB1.
5. Connect the other end of the communication bus cable to the remainder of the CCN communication bus at the COMM1 plug located on the fuse and control circuit breaker bracket in the unit main control box.

Air Pressure Tubing — Before options such as supply fan VFD and modulating power exhaust can operate properly, the pneumatic tubes for pressure sensing must be installed. The recommended field-supplied tubing for this use is a nominal 1/4-in., fire-retardant tubing.

The tubing must be run from the appropriate location in the building to the auxiliary control box in the unit. Figures 31 and 32 show the location and layout of the auxiliary control box in the 48/50MP unit. Figure 33 shows the connection locations for the tubing on the duct pressure (DP) controller for the VFD on the supply fan and on the building pressure (BP) controller for the VFD on the modulating power exhaust fan.

The tubing for the duct pressure control (DP) should sample supply duct pressure about 2/3 of the way out from the unit in the main trunk duct. The tubing for the building pressure control (BP) should sample building pressure in the area near the entrance lobby so that location is controlled as closely to design pressures as possible.

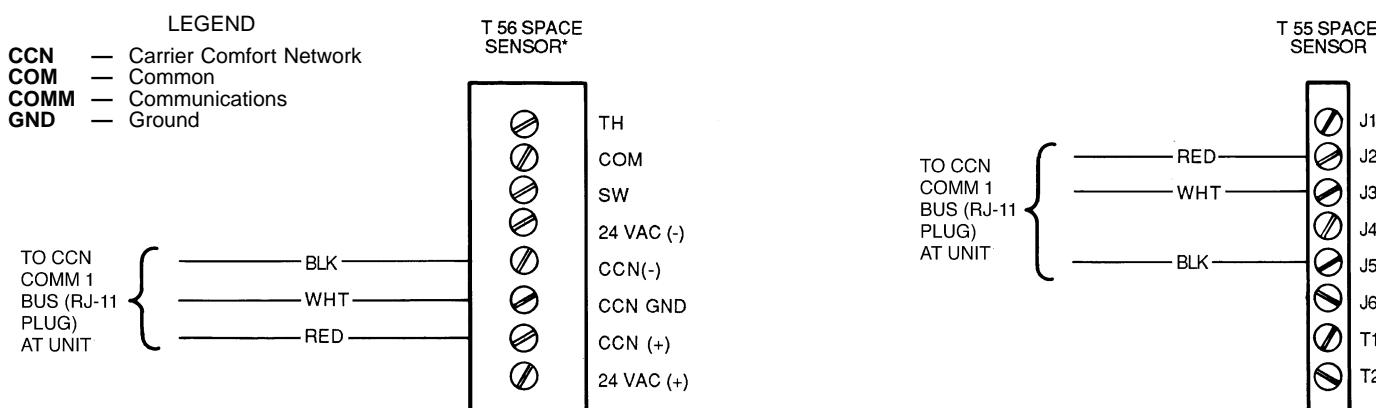
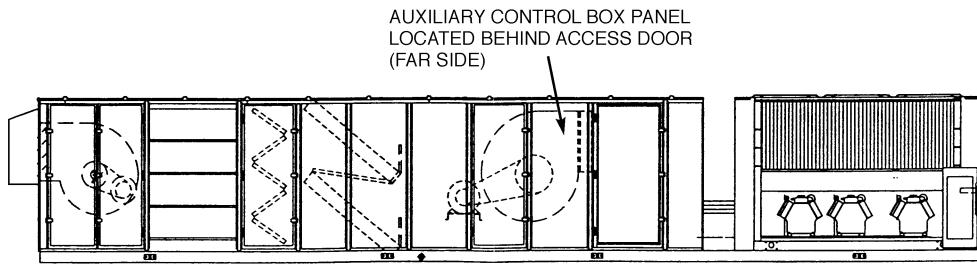


Fig. 30 — Space Sensor to Communication Bus Wiring



**Fig. 31 — Auxiliary Control Box Location
(50MP70M Unit Shown)**

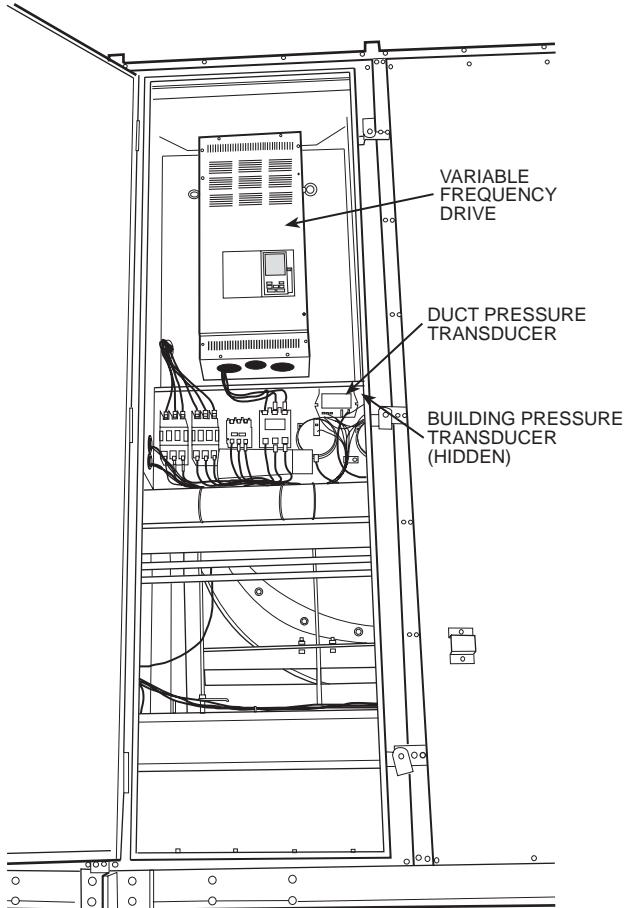
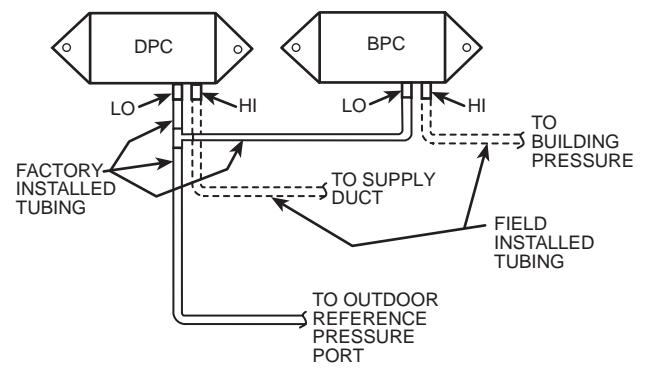


Fig. 32 — Auxiliary Control Box



LEGEND
BPC — Building Pressure Controller
DPC — Duct Pressure Controller

Fig. 33 — Air Pressure Tubing Locations

Gas Piping (48 Series Units Only) — Unit is equipped for use with natural gas only. Installation must conform with local building codes, or in the absence of local codes, with the National Fuel Gas Code, ANSI Z223.1.

A $\frac{1}{8}$ -in. NPT tapping plug, accessible for test gage connection, must be field installed immediately upstream of gas supply connection to unit, but after manual gas valve. See Fig. 34. Natural gas pressure at unit gas connection must not be less than 5 in. wg or greater than 13 in. wg.

Size gas supply piping for 0.5 in. wg maximum pressure drop. Do not use supply pipe smaller than unit gas connection.

⚠ CAUTION

Disconnect gas piping from unit when leak testing at pressures greater than 0.5 psig. Pressures greater than 0.5 psig will cause gas valve damage resulting in a hazardous condition. If gas valve is subjected to pressure greater than 0.5 psig, it must be replaced.

Installing Flue/Inlet Hoods (48MP Units Only)

The flue/inlet hoods are shipped in a bag taped to the basepan in the gas section of the unit.

UNITS SIZES 62L AND 70M — The high heat units (48MPE), have 3 flue hoods, 3 flue deflector hoods, and one inlet air hood to be field installed. See Fig. 35. The low heat units (48MPD) have 2 flue hoods, 2 flue deflector hoods, and one inlet air hood.

Remove the shipping block offs and shipping tape from the flue openings in the access panel and the corner post. The inlet hood is shipped unassembled and must be assembled before mounting to the access panel. See Fig. 36. Install inlet screen on inlet hood using speed clips and screws provided.

Attach the flue hoods to access panel and corner post using screws provided. See Fig. 37. Hoods go over each combustion air outlet.

Install the flue deflector baffle inside the flue deflector hood. See Fig. 38. Install flue deflector hoods over each flue hood.

UNIT SIZES 82N, 90P, and 10R — The high heat units (48MPE), have 3 flue hoods and 3 flue deflector hoods to be field installed. See Fig. 35. The low heat units (48MPD), have 2 flue hoods and 2 flue deflector hoods.

Remove the shipping block offs and shipping tape from the flue openings in the access panel and the corner post.

Attach the flue hoods to access panel and corner post using screws provided. See Fig. 37. Hoods go over each combustion air outlet.

Install the flue deflector baffle inside the flue deflector hood. See Fig. 38. Install the flue deflector hoods over each flue hood.

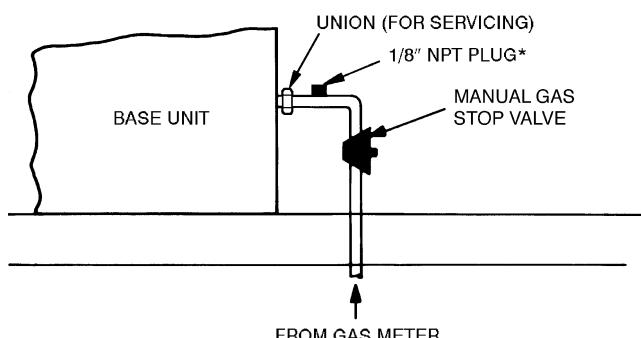


Fig. 34 — Gas Piping Details

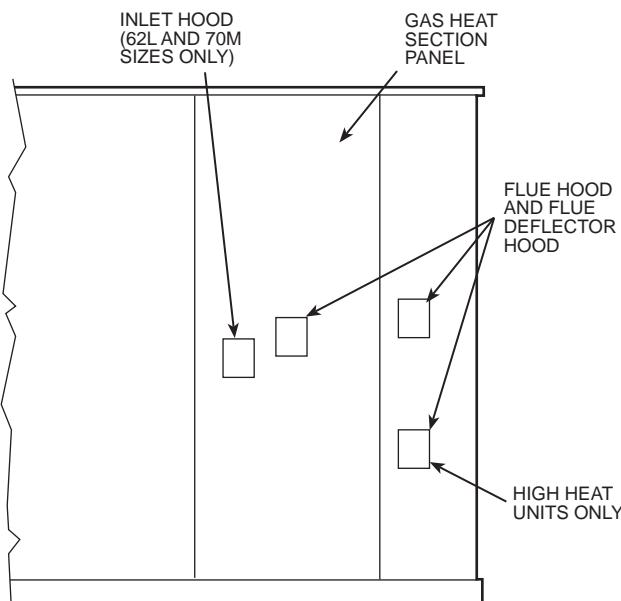


Fig. 35 — Flue and Inlet Hood Locations
(48MP Units Only)

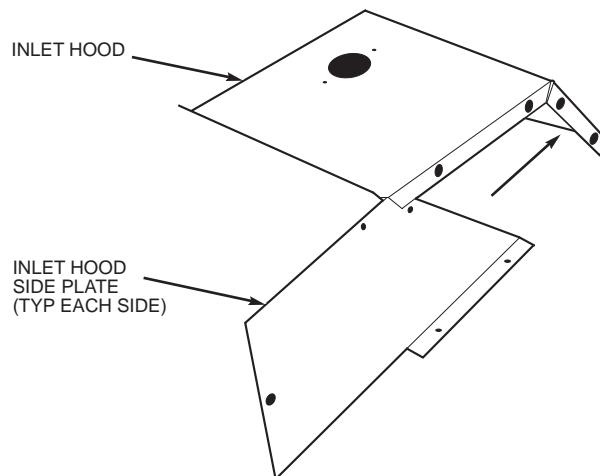


Fig. 36 — Inlet Hood Assembly

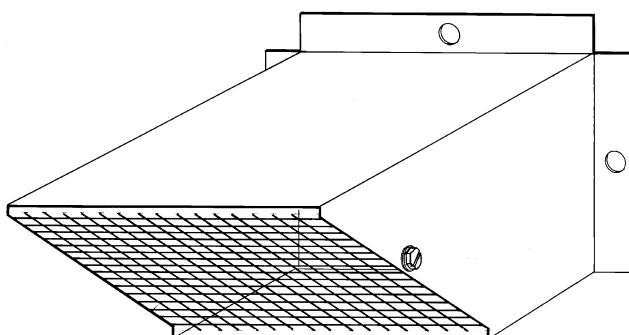


Fig. 37 — Flue Hood

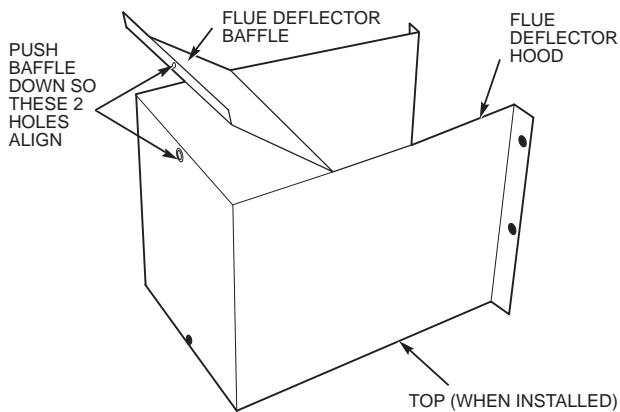


Fig. 38 — Flue Deflector Baffle (Assembled)

Fan Isolator Adjustment — Remove shipping hardware from both the supply fan and the optional exhaust fan. The indoor fan shipping blocks on both the supply fan and the optional power exhaust fan (4 per fan) must be removed from each corner of the fan sled before starting unit. Remove shipping bolt connecting bottom flanges of the fan sled crossrail with the fan support rail. Remove the wooden shipping block from each corner. See Fig. 39.

After removing all shipping blocks, level fan sled using the adjusting screws of the spring isolators. Verify dimensions from fan support rail to fan sled cross rail of 7-in. on all 4 corners.

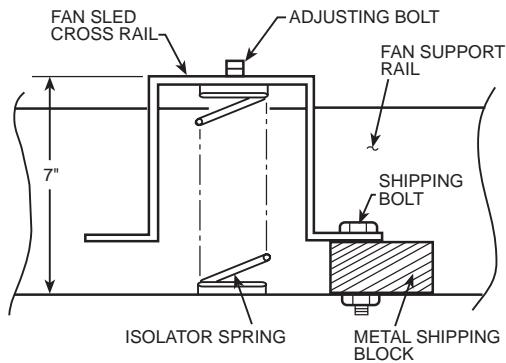
To adjust, loosen the locknut on top of the adjusting bolt. Turn the bolt clockwise to decrease the height. Turn the bolt counterclockwise to increase the height. Tighten the locknut after adjustment is complete. Make sure that the fan sled assemblies float freely during and after adjustment.

Check Compressor Mounting

UNITS 48/50MP62L — Compressors are mounted on pans and are held down by 4 rail bolts during shipment. After unit is installed, loosen each of these bolts until the snubber washer can be moved with finger pressure. See Fig. 40 and 41.

UNITS 48/50MP70M-10R — Compressors are mounted on rails and held down by rail bolts during shipment. After unit is installed, loosen the rail bolts to allow the rails and compressors to float freely on the springs located under the rails. See Fig. 40, 42, and 43.

Install Accessories — For applications requiring special accessories, the following packages are available: condenser coil hail guard package, condenser coil protective grilles, and compressor security grilles. Refer to the accessory installation instructions for information on accessory installation.



VIEW FROM INSIDE UNIT LOOKING OUT

Fig. 39 — Fan isolator Adjustment

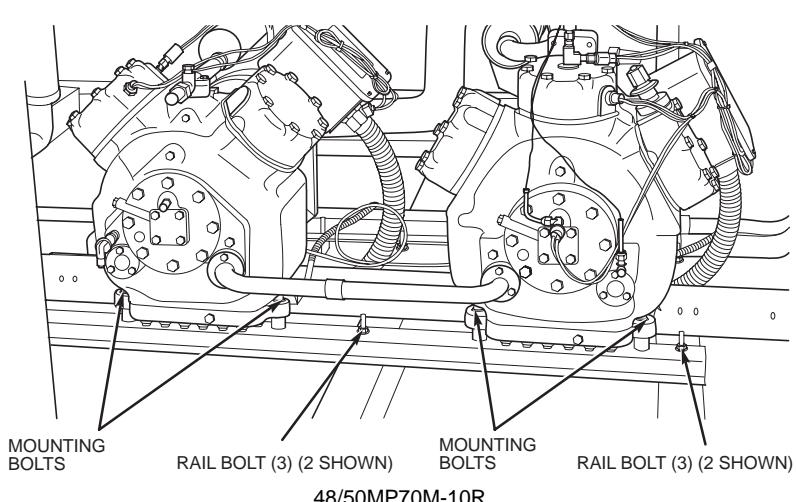
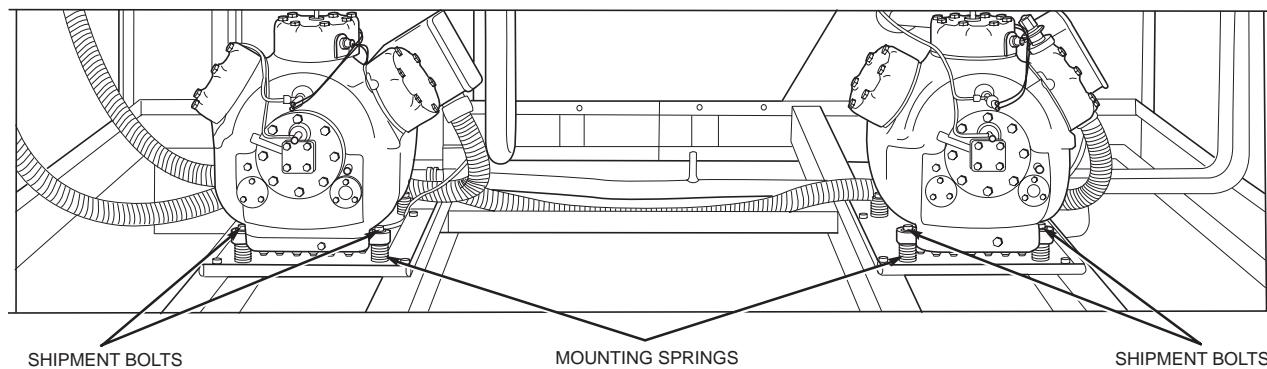


Fig. 40 — Outer View, Compressor Mounting

PRE-START-UP

IMPORTANT: Before beginning Pre-Start-Up or Start-Up, review Start-Up Checklist at the center of this publication. The Checklist assures proper start-up of a unit and provides a record of unit condition, application requirements, system information, and operation at initial start-up.

Do not attempt to start the air-conditioning system until following checks have been completed.

System Check

1. Check the outside air hoods to ensure the hoods are fully opened and secure, with filters in place.
2. Check the supply fan and exhaust fan suspension brackets. Shipping spacers should be removed and sleds levelled to specification.
3. Check compressor suspension. On 48/50MP62L units snubber washers can be moved with finger pressure. On all other units, rails allow compressors to float freely on compressor rail springs.
4. Electrical power source must agree with unit nameplate.
5. Check tightness of all electrical connections.

⚠ CAUTION

Failure to open discharge service valve prior to starting compressor can result in damage to or failure of the compressor.

6. Backseat (open) compressor suction and discharge shut-off valves. Close valves one turn to allow refrigerant pressure to reach the test gages.
7. Open liquid line service valves.
8. Oil should be visible in the compressor sight glasses. See Fig. 44. An acceptable oil level in the compressor is from $\frac{3}{8}$ to $\frac{1}{2}$ of sight glass (06E-299 compressors are $\frac{1}{8}$ of sight glass). Adjust the oil level as required. No oil should be removed unless the crankcase heater has been energized for at least 24 hours. Oil Charge section on page 49 for Carrier-approved oils.
9. Perform leak test. Be sure there are no refrigerant leaks. All units are shipped with a complete operating charge of R-22 and should be under sufficient pressure for leak testing after installation. If there is no system pressure, add refrigerant until a pressure is observed and check for leaks. After leaks are repaired, remove and recover refrigerant from system. For leak testing procedures, see GTAC 2, Module 5, Charging, Recovery, Recycling and Reclamation section. Do not use the system compressors to remove refrigerant from the system.
10. *Crankcase heaters must be firmly locked into compressors, and must be on for 24 hours prior to start-up.*

⚠ CAUTION

Crankcase heaters on all units are wired into the control circuit, so they are always operable as long as the main power supply disconnect is on (closed), even if any safety device is open. Compressor heaters must be on for 24 hours prior to the start-up of any compressor.

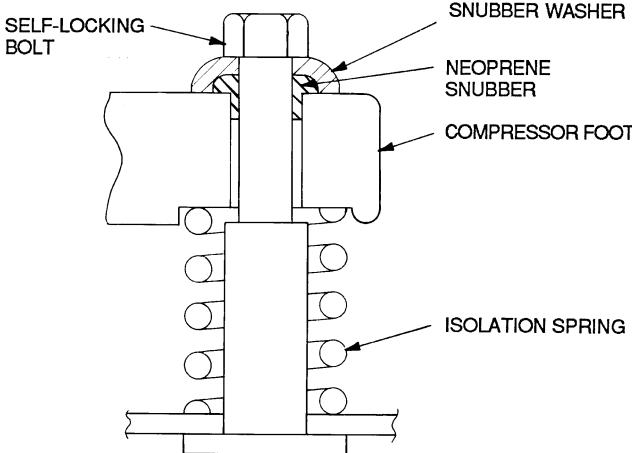


Fig. 41 — Compressor Mounting — 48/50MP62L Units

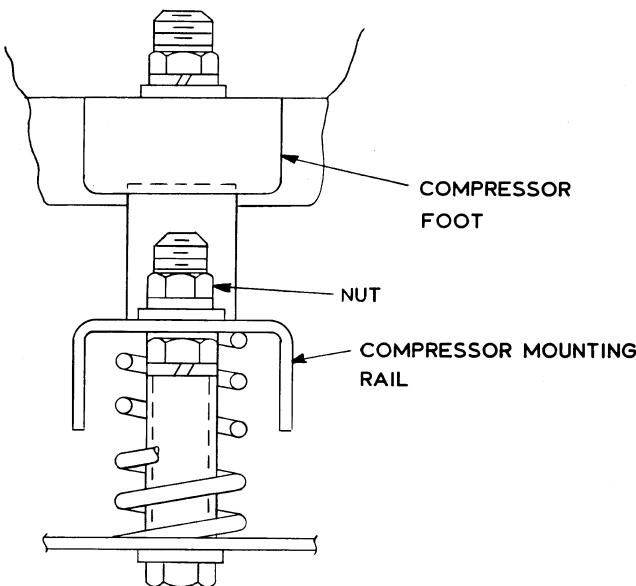


Fig. 42 — Front View of Compressor Mounting Rail Assembly — 48/50MP70M-10R Units

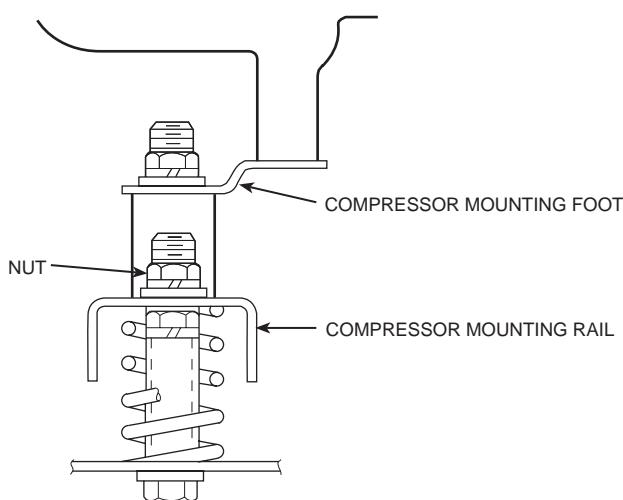


Fig. 43 — Rear View of Compressor Mounting Rail Assembly — 48/50MP70M-10R Units

11. Check supply fan belts, sheaves, and bearings. Check the lubrication of the fan and motor bearings. Check bearing and bearing set screws for tightness. Check sheave alignment and belt tension. Hand turn fan to ensure fan wheel does not rub on housing. The fan shaft and motor shaft must turn freely before power is applied to the unit.
12. Check exhaust fan belts, sheaves, and bearings. Check the lubrication of the fan and motor bearings. Check bearing and bearing set screws for tightness. Check sheave alignment and belt tension. Hand turn fan to ensure fan wheel does not rub on housing.
13. Check economizer linkage. Economizer dampers should be fully closed. Linkage should permit full and free travel.
14. Check that the correct return air filters are installed in the filter tracks. Do not operate unit without return air filters.
15. Check that all access doors on the air handler section have been closed and secured.
16. Fan motors are 3-phase. Check rotation of fans during first start-up check. Fan rotation is clockwise as viewed from top of unit. If fan is not turning clockwise, reverse 2 of the power wires.

Compressor Oil — Check that compressor oil is visible in the sight glass of the compressor. All units are factory charged with oil. See Table 3. Observe oil level closely at start-up. If oil level is below the sight glass and cannot be seen, add oil until the level is approximately $\frac{3}{8}$ to $\frac{1}{8}$ of sight glass (06E-299 compressors are $\frac{1}{8}$ of sight glass). See Fig. 44. See Oil Charge section on page 49 for information on adding or removing oil.

If oil charge is above sight glass, do not remove any oil until the compressor crankcase heater has been on for at least 24 hours. When additional oil or a complete charge is needed, use only Carrier-approved compressor oil.

Do not reuse drained oil and do not use any oil that has been exposed to the atmosphere.

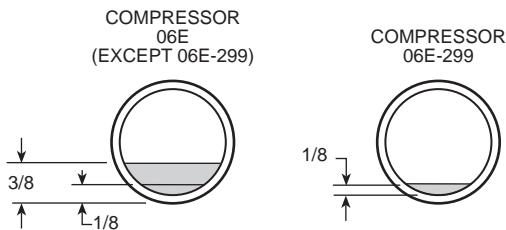


Fig. 44 — Operating Oil Levels (Sight Glass)

Evaporator-Fan Belts, Pulleys, and Sheaves —

Belts, pulleys, and sheaves are factory installed. All pulleys are nonadjustable.

See Table 1 for fan shaft center distance ranges and shaft sizes when making selections for field-supplied drives.

Factory-installed drives are fixed-speed and are non-adjustable. Refer to Table 1 for factory-supplied wheel speeds and drive set data.

If different wheel speeds are required for an application, Carrier recommends that the installer contact the nearest Browning dealer. The Browning dealer can develop the required information for the fan drive set.

Observe the maximum wheel speed and unit airflow limits for the specific unit size and fan type.

See Tables 8-12 for forward curve supply fan performance. See Tables 13-17 for air foil supply fan performance.

FAN PERFORMANCE, 48MP UNITS — To obtain fan performance for 48MP units:

1. Enter fan performance table for appropriate base unit type and unit size.
2. Determine the external static pressure from the fan performance table using fan type, field-measured rpm, and airflow (cfm).
3. Refer to the Component Pressure Drops table (Table 18) on page 35. Calculate the adjusted external static pressure value for the correct unit size and airflow for gas heat units.
4. Calculate the net external static pressure for the gas heat units by subtracting the adjusted external static pressure value from Table 18 (Step 3) from the external static pressure from the fan performance table (Step 2).

EXAMPLE:

Field Measurements:

Unit: 48MP62L

Fan Type: Forward Curved

RPM: 500

CFM: 22,000

1. Select Fan Performance Table 8, 48/50MP62L with Forward Curved fan.
2. Determine external static pressure using 500 rpm and 22,000 cfm. ESP = 1.25.
3. Read the adjusted external static pressure from the Component Static Pressure Drops table for 48MP62L gas heat units at 22,000 cfm. Adjusted ESP = 0.31.
4. Calculate external static pressure.

$$\begin{aligned} \text{ESP} &= \text{ESP} - \text{ESP Adjusted} \\ &= 1.25 - 0.31 \\ &= 0.94 \text{ in. wg} \end{aligned}$$

Check rotation of wheel with arrow on the fan housing. Check fan speed with a strobe-type tachometer, or use this formula:

$$\text{Fan Rpm} = \frac{\text{motor rpm} \times \text{motor sheave pitch diameter (in.)}}{\text{fan sheave pitch diameter (in.)}}$$

(Obtain motor rpm from the fan motor nameplate and read sheave pitch diameters marked on the fan and motor sheaves.)

EXAMPLE:

Nameplate motor rpm	1760
Motor sheave pitch diameter (in.)	6.4
Fan sheave pitch diameter (in.)	12.4

$$\text{Fan Rpm} = \frac{1760 \times 6.4}{12.4} = 908 \text{ Rpm}$$

The maximum allowable fan speed for the supply fan is shown in Table 19. The maximum allowable fan speed for the power exhaust fan is shown in Table 20.

Excessive fan speed may result in condensate carryover from the evaporator coil, fan motor overload, or wheel failure. See Table 21 for Air Quantity Limits on page 35.

Table 8 — Fan Performance (Forward Curved) — 48/50MP62L*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	0.50		0.75		1.00		1.25		1.50		1.75	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
16,000	346	3.4	382	4.1	415	5.0	448	6.0	478	7.2	508	8.6
18,000	371	4.7	404	5.5	436	6.4	466	7.4	494	8.6	522	10.0
20,000	398	6.3	428	7.2	458	8.2	486	9.3	513	10.5	539	11.9
22,000	426	8.4	454	9.4	481	10.5	508	11.6	533	12.9	558	14.3
24,000	455	11.0	481	12.1	506	13.3	531	14.5	555	15.8	578	17.3
26,000	484	14.2	508	15.4	532	16.6	555	18.0	578	19.4	600	20.9
28,000	514	18.0	537	19.3	559	20.7	581	22.1	602	23.6	623	25.2
30,000	544	22.5	566	23.9	587	25.4	608	26.9	628	28.5	648	30.2
32,000	575	27.9	595	29.4	615	30.9	635	32.6	654	34.3	673	36.1

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)							
	2.00		2.25		2.50		2.75	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
16,000	536	10.1	563	11.9	590	13.9	615	16.0
18,000	549	11.5	575	13.2	600	15.1	624	17.1
20,000	564	13.4	589	15.1	613	16.9	636	18.9
22,000	582	15.8	605	17.5	628	19.3	650	21.3
24,000	601	18.9	623	20.6	645	22.4	666	24.3
26,000	622	22.5	643	24.3	664	26.1	684	28.1
28,000	644	26.9	664	28.7	684	30.6	703	32.6
30,000	667	32.0	686	33.9	705	35.8	724	37.9
32,000	692	38.0	710	39.9	728	42.0	746	44.1

LEGEND

Bhp — Brake Horsepower

*Refer to Fan Performance, 48MP Units section, for correct procedure on 48MP units.

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. Conversion — Bhp to kW:

$$kW = \frac{Bhp \times .746}{\text{Motor efficiency}}$$

See Table 1 for motor efficiency.

Table 9 — Fan Performance (Forward Curved) — 48/50MP70M*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	0.50		0.75		1.00		1.25		1.50		1.75	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
18,000	365	6.4	398	7.4	432	8.5	465	9.8	499	11.1	532	12.6
20,000	391	8.2	421	9.3	451	10.4	482	11.7	512	13.1	542	14.5
22,000	418	10.4	446	11.5	473	12.7	501	14.0	528	15.4	556	16.9
24,000	447	12.9	472	14.1	497	15.4	523	16.8	548	18.2	573	19.7
26,000	476	15.9	499	17.2	523	18.6	546	20.0	569	21.5	592	23.0
28,000	506	19.4	527	20.8	549	22.2	571	23.6	592	25.2	614	26.8
30,000	536	23.4	556	24.8	576	26.3	596	27.8	617	29.4	637	31.0
32,000	566	27.9	585	29.4	604	30.9	623	32.5	642	34.2	661	35.9
34,000	597	32.9	615	34.5	633	36.1	651	37.8	668	39.5	686	41.3
36,000	628	38.6	645	40.2	662	41.9	679	43.7	695	45.4	712	47.3

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	2.00		2.25		2.50		2.75		300		325	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
18,000	565	14.2	598	16.0	631	17.8	664	19.9	696	22.1	729	24.4
20,000	572	16.1	602	17.8	631	19.6	661	21.5	691	23.6	720	25.8
22,000	583	18.5	610	20.2	638	21.9	665	23.8	692	25.8	719	27.9
24,000	598	21.3	623	23.0	648	24.7	673	26.6	698	28.5	723	30.6
26,000	616	24.6	639	26.3	662	28.1	685	29.9	708	31.9	731	33.9
28,000	635	28.4	657	30.1	679	31.9	700	33.8	722	35.7	743	37.7
30,000	657	32.7	677	34.5	697	36.3	717	38.2	737	40.2	758	42.2
32,000	680	37.6	699	39.4	718	41.3	737	43.2	756	45.2	774	47.2
34,000	704	43.1	722	44.9	740	46.8	757	48.8	775	50.8	793	52.9
36,000	729	49.1	746	51.0	763	53.0	780	55.0	796	57.1	813	59.2

LEGEND

Bhp — Brake Horsepower

*Refer to Fan Performance, 48MP Units section, for correct procedure on 48MP units.

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. Conversion — Bhp to kW:

$$kW = \frac{Bhp \times .746}{\text{Motor efficiency}}$$

See Table 1 for motor efficiency.

Table 10 — Fan Performance (Forward Curved) — 48/50MP82N*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	0.50		0.75		1.00		1.25		1.50		1.75	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
22,000	293	6.2	326	7.7	359	9.3	392	11.2	425	13.2	457	15.3
24,000	308	7.6	339	9.1	369	10.8	399	12.7	429	14.7	459	16.9
26,000	324	9.2	352	10.8	380	12.6	408	14.5	436	16.6	464	18.8
28,000	341	11.0	367	12.7	393	14.6	419	16.5	445	18.7	471	20.9
30,000	358	13.1	382	14.9	407	16.8	431	18.9	455	21.1	480	23.4
32,000	375	15.5	398	17.4	421	19.4	444	21.5	467	23.8	490	26.2
34,000	393	18.2	415	20.2	436	22.3	458	24.5	479	26.8	501	29.3
36,000	411	21.2	432	23.3	452	25.5	473	27.8	493	30.2	513	32.7
38,000	430	24.6	449	26.8	468	29.1	488	31.4	507	33.9	526	36.5
40,000	448	28.3	467	30.6	485	33.0	504	35.5	522	38.1	540	40.7
42,000	467	32.5	485	34.9	502	37.3	520	39.9	537	42.6	555	45.4

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	2.00		2.25		2.50		2.75		3.00			
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp		
22,000	462	15.0	489	16.8	515	18.7	541	20.7	567	22.9		
24,000	466	16.6	491	18.5	516	20.4	540	22.4	564	24.5		
26,000	472	18.6	495	20.4	519	22.3	542	24.4	564	26.5		
28,000	480	20.8	502	22.7	524	24.6	546	26.7	567	28.8		
30,000	489	23.4	510	25.3	531	27.2	551	29.3	572	31.4		
32,000	500	26.2	520	28.1	539	30.2	559	32.2	578	34.4		
34,000	512	29.4	530	31.4	549	33.4	568	35.5	586	37.7		
36,000	524	32.9	542	34.9	560	37.0	578	39.2	595	41.4		
38,000	538	36.8	555	38.9	572	41.0	589	43.2	605	45.5		
40,000	552	41.0	568	43.2	584	45.4	601	47.7	617	50.0		
42,000	567	45.7	582	47.9	598	50.2	613	52.5	629	54.9		

LEGEND

Bhp — Brake Horsepower

*Refer to Fan Performance, 48MP Units section, for correct procedure on 48MP units.

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. Conversion — Bhp to kW:

$$\text{kW} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Table 1 for motor efficiency.

Table 11 — Fan Performance (Forward Curved) — 48/50MP90P*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	0.50		0.75		1.00		1.25		1.50		1.75	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
22,000	297	6.9	329	7.9	360	8.9	375	9.8	402	11.4	430	13.0
24,000	313	8.5	343	9.6	371	10.7	395	11.7	420	13.2	445	14.8
26,000	330	10.3	357	11.5	384	12.7	410	13.8	430	15.3	452	16.9
28,000	347	12.3	373	13.6	398	14.9	422	16.2	442	17.4	462	19.0
30,000	365	14.6	389	16.0	412	17.4	436	18.8	449	19.8	469	21.4
32,000	381	16.5	400	17.9	420	19.4	440	21.0	460	22.7	480	24.5
34,000	400	19.4	418	20.9	437	22.4	455	24.1	474	25.8	493	27.6
36,000	419	22.6	437	24.2	454	25.8	472	27.5	489	29.3	507	31.2
38,000	439	26.2	455	27.9	472	29.6	488	31.3	505	33.2	522	35.1
40,000	458	30.3	474	32.0	490	33.7	505	35.5	521	37.4	537	39.4
42,000	478	34.7	493	36.4	508	38.3	523	40.2	538	42.1	553	44.1
44,000	498	39.5	512	41.3	527	43.2	541	45.2	555	47.2	570	49.3
46,000	518	44.8	532	46.7	546	48.7	559	50.7	573	52.8	587	54.9
AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	2.00		2.25		2.50		2.75		3.00			
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp		
22,000	455	14.5	480	16.0	506	17.8	532	19.5	555	21.5	578	23.5
24,000	465	16.4	485	18.0	515	20.0	545	22.0	568	23.8	590	25.5
26,000	475	18.5	500	20.5	525	22.5	548	24.5	570	26.2	590	28.0
28,000	486	20.8	510	22.5	531	24.5	552	26.5	572	28.5	592	30.5
30,000	488	23.0	510	24.8	532	26.5	552	28.6	572	30.8	590	33.0
32,000	501	26.3	522	28.3	542	30.4	563	32.5	585	34.8	602	36.5
34,000	512	29.5	532	31.5	551	33.6	571	35.8	590	38.1	610	40.4
36,000	525	33.1	543	35.1	561	37.2	580	39.4	598	41.7	617	44.1
38,000	539	37.1	556	39.1	573	41.2	590	43.5	607	45.7	625	48.1
40,000	553	41.4	569	43.5	585	45.7	602	47.9	618	50.2	634	52.6
42,000	568	46.2	584	48.3	599	50.5	614	52.8	630	55.2	645	57.6
44,000	584	51.4	599	53.6	613	55.8	628	58.2	642	60.6	657	63.0
46,000	600	57.1	614	59.3	628	61.6	642	64.0	656	66.4	670	68.0

LEGEND

Bhp — Brake Horsepower

*Refer to Fan Performance, 48MP Units section, for correct procedure on 48MP units.

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. Conversion — Bhp to kW:

$$\text{kW} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Table 1 for motor efficiency.

Table 12 — Fan Performance (Forward Curved) — 48/50MP10R*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	0.50		0.75		1.00		1.25		1.50		1.75	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
26,000	315	9.5	346	10.9	367	10.9	390	12.4	412	14.0	434	15.7
28,000	330	11.2	359	12.7	380	14.0	401	14.9	422	16.0	446	17.7
30,000	346	13.2	372	14.8	399	16.8	417	17.6	435	18.5	460	20.2
32,000	368	15.6	386	16.9	415	18.8	438	20.8	461	22.8	490	24.1
34,000	386	18.4	404	19.7	430	21.8	450	23.5	470	25.2	490	26.8
36,000	405	21.5	421	22.9	446	24.4	468	26.3	489	28.2	506	30.1
38,000	424	24.9	449	26.4	464	28.0	471	29.6	501	31.3	417	33.4
40,000	443	28.7	458	30.3	473	31.9	487	33.6	513	35.3	530	37.1
42,000	463	33.0	476	34.6	490	36.2	505	38.0	532	39.7	547	41.6
44,000	482	37.6	495	39.2	509	41.0	522	42.8	542	44.6	556	46.5
46,000	502	42.6	514	44.3	527	46.1	540	48.0	553	49.9	566	51.8
48,000	521	48.1	533	49.9	546	51.7	558	53.6	570	55.6	582	57.6
50,000	541	54.0	553	55.9	564	57.8	576	59.8	588	61.8	600	63.9
52,000	561	60.5	572	62.4	583	64.4	594	66.4	606	68.5	617	70.6

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	2.00		2.25		2.50		2.75		3.00		3.25	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
26,000	455	17.5	480	19.0	505	20.5	528	22.4	550	24.5	572	26.5
28,000	470	19.5	490	21.2	510	23.0	532	24.7	555	26.5	580	29.0
30,000	485	22.0	502	23.8	520	25.5	539	27.5	558	29.5	580	31.5
32,000	500	25.5	519	27.5	538	29.5	558	31.1	577	32.8	595	35.1
34,000	511	28.5	530	30.7	548	33.0	567	34.3	586	35.7	601	38.0
36,000	522	32.0	538	33.7	555	35.5	574	37.3	592	39.1	608	41.4
38,000	533	35.5	550	37.5	566	39.6	582	41.2	599	42.9	615	45.2
40,000	547	39.8	562	41.3	576	42.9	592	45.0	608	47.1	622	49.4
42,000	562	43.5	577	45.5	592	47.5	603	49.6	614	51.8	628	54.0
44,000	570	48.4	584	50.5	598	52.5	608	54.7	619	56.9	633	59.1
46,000	579	53.8	592	55.9	605	58.0	618	60.2	632	62.4	646	64.7
48,000	595	59.7	607	61.8	620	63.9	633	66.1	646	68.4	659	70.8
50,000	612	66.0	624	68.1	636	70.3	648	72.6	660	74.9	672	77.3
52,000	629	72.8	640	75.0	652	77.2	663	79.5	675	81.9	687	84.3

LEGEND

Bhp — Brake Horsepower

*Refer to Fan Performance, 48MP Units section, for correct procedure on 48MP units.

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. Conversion — Bhp to kW:

$$\text{kW} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Table 1 for motor efficiency.

Table 13 — Fan Performance (Air Foil) — 48/50MP62L*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	0.25		0.50		0.75		1.00		1.25		1.50	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
16,000	581	3.4	620	4.1	656	4.8	694	5.5	731	6.4	765	7.2
18,000	637	4.5	672	5.2	706	6.0	738	6.8	771	7.6	805	8.5
20,000	698	5.8	730	6.7	761	7.6	792	8.4	820	9.3	849	10.1
22,000	757	7.4	787	8.4	815	9.3	843	10.2	871	11.1	897	12.1
24,000	815	9.2	843	10.2	870	11.2	895	12.3	921	13.3	946	14.3
26,000	877	11.4	904	12.5	929	13.7	953	14.8	977	15.9	1001	17.0
28,000	937	13.9	962	15.1	986	16.3	1009	17.5	1031	18.7	1053	19.9
30,000	995	16.6	1019	17.9	1042	19.2	1064	20.5	1085	21.8	1106	23.1
32,000	1055	19.8	1078	21.2	1100	22.6	1121	23.9	1141	25.3	1161	26.7

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)											
	2.75		3.00		3.25		3.50		3.75		4.00	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
16,000	929	11.7	959	12.7	—	—	—	—	—	—	—	—
18,000	957	13.4	986	14.4	1015	15.5	1042	16.6	1068	17.7	1094	18.8
20,000	991	15.4	1019	16.5	1046	17.6	1073	18.8	1099	19.9	1124	21.1
22,000	1030	17.5	1055	18.7	1079	19.9	1103	21.1	1129	22.3	1154	23.6
24,000	1069	19.9	1094	21.2	1117	22.4	1140	23.7	1163	24.9	1185	26.2
26,000	1114	22.8	1137	24.1	1160	25.4	1183	26.8	1204	28.1	1226	29.5
28,000	1158	25.9	1179	27.2	1201	28.6	1223	30.0	1244	31.4	1265	32.9
30,000	1207	29.5	1226	30.8	1244	32.1	1264	33.5	1285	35.0	1305	36.5
32,000	1257	33.5	1275	34.9	1293	36.3	1311	37.6	1328	39.0	1346	40.5

LEGEND

Bhp — Brake Horsepower

*Refer to Fan Performance, 48MP Units section, for correct procedure on 48MP units.

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. Conversion — Bhp to kW:

$$\text{kW} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Table 1 for motor efficiency.

Table 14 — Fan Performance (Air Foil) — 48/50MP70M*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.50		0.75		1.00		1.25		1.50		1.75		2.00		2.25		2.50			
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp		
18,000	668	5.1	702	5.9	735	6.7	767	7.5	801	8.4	833	9.3	863	10.3	893	11.2	924	12.2	954	13.3
20,000	725	6.6	756	7.4	787	8.3	816	9.1	844	10.0	875	11.0	905	12.0	933	13.1	961	14.1	987	15.2
22,000	781	8.2	809	9.1	838	10.0	865	10.9	892	11.9	917	12.8	945	13.9	973	15.0	999	16.2	1025	17.3
24,000	837	10.0	864	11.0	890	12.1	916	13.1	941	14.1	966	15.1	989	16.2	1013	17.3	1039	18.5	1065	19.7
26,000	898	12.3	923	13.4	947	14.5	971	15.6	995	16.7	1018	17.8	1041	19.0	1063	20.1	1084	21.2	1108	22.5
28,000	955	14.8	979	16.0	1002	17.2	1025	18.4	1047	19.6	1069	20.8	1091	21.9	1112	23.1	1133	24.3	1153	25.6
30,000	1011	17.4	1034	18.8	1056	20.0	1078	21.3	1098	22.6	1119	23.9	1140	25.2	1160	26.5	1180	27.7	1200	29.0
32,000	1071	20.7	1093	22.1	1114	23.5	1135	24.9	1154	26.2	1174	27.6	1193	29.0	1213	30.4	1232	31.7	1251	33.1
34,000	1129	24.3	1150	25.7	1171	27.2	1190	28.7	1210	30.1	1228	31.6	1246	33.4	1264	34.6	1283	36.0	1301	37.4
36,000	1186	28.1	1207	29.6	1226	31.2	1245	32.8	1264	34.3	1282	35.9	1299	37.4	1317	39.0	1334	40.5	1351	42.1

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																	
	3.00		3.25		3.50		3.75		4.00		4.25		4.50		4.75		5.00	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
18,000	983	14.3	1011	15.4	1039	16.4	1065	17.5	1091	18.6	—	—	—	—	—	—	—	—
20,000	1014	16.3	1042	17.4	1069	18.6	1095	19.7	1120	20.9	1145	22.1	1169	23.3	1193	24.5	1216	25.8
22,000	1050	18.5	1074	19.6	1098	20.8	1124	22.1	1149	23.3	1173	24.6	1197	25.9	1220	27.2	1243	28.5
24,000	1089	20.9	1113	22.2	1136	23.4	1158	24.7	1180	26.0	1202	27.3	1226	28.6	1249	30.0	1271	31.4
26,000	1132	23.8	1155	25.1	1177	26.4	1199	27.8	1221	29.1	1242	30.5	1262	31.9	1282	33.3	1303	34.7
28,000	1172	26.8	1195	28.2	1217	29.6	1239	31.0	1260	32.5	1280	33.9	1300	35.4	1320	36.8	1340	38.3
30,000	1219	30.3	1238	31.6	1256	32.9	1277	34.4	1298	35.9	1318	37.5	1338	39.0	1357	40.5	1376	42.1
32,000	1270	34.4	1288	35.8	1305	37.2	1323	38.6	1340	40.0	1360	41.6	1379	43.2	1398	44.8	1417	46.4
34,000	1319	38.9	1337	40.3	1354	41.8	1371	43.2	1388	44.7	1404	46.2	1420	47.7	1439	49.3	1457	51.0
36,000	1369	43.6	1386	45.1	1403	46.6	1419	48.2	1435	49.7	1451	51.3	1467	52.8	1483	54.4	1498	55.9

LEGEND

Bhp — Brake Horsepower

*Refer to Fan Performance, 48MP Units section, for correct procedure on 48MP units.

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. Conversion — Bhp to kW:

$$\text{kW} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Table 1 for motor efficiency.

Table 15 — Fan Performance (Air Foil) — 48/50MP82N*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																			
	0.50		0.75		1.00		1.25		1.50		1.75		2.00		2.25		2.50			
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp		
20,000	449	4.1	485	5.0	519	6.0	551	7.0	583	8.1	616	9.4	—	—	—	—	—	—		
22,000	477	4.9	511	5.9	543	7.0	574	8.1	602	9.2	631	10.3	661	11.7	—	—	—	—		
24,000	505	5.9	538	7.0	568	8.1	598	9.2	626	10.4	652	11.6	677	12.9	706	14.3	733	15.8	—	
26,000	535	7.0	565	8.1	594	9.3	622	10.5	649	11.7	675	13.0	699	14.4	723	15.7	748	17.2	773	18.7
28,000	563	8.1	591	9.3	619	10.6	646	11.9	671	13.2	697	14.5	721	15.9	744	17.3	766	18.8	787	20.2
30,000	595	9.6	621	10.8	647	12.1	673	13.5	698	14.9	721	16.3	745	17.8	767	19.3	789	20.8	810	22.3
32,000	624	11.0	649	12.3	673	13.7	698	15.2	722	16.6	745	18.1	767	19.6	789	21.2	811	22.8	831	24.4
34,000	655	12.7	679	14.1	702	15.6	725	17.1	748	18.7	770	20.2	792	21.8	813	23.4	834	25.0	854	26.7
36,000	685	14.6	709	16.1	731	17.6	752	19.2	771	20.8	796	22.4	817	24.1	838	25.8	857	27.5	877	29.2
38,000	717	16.7	739	18.3	761	19.9	781	21.5	801	23.2	822	24.9	843	26.6	863	28.4	882	30.1	901	31.9
40,000	748	18.9	769	20.5	789	22.2	809	24.0	829	25.7	848	27.4	868	29.3	888	31.1	907	32.9	925	34.8
42,000	779	21.3	799	23.1	819	24.8	838	26.6	857	28.4	875	30.3	894	32.1	913	34.0	931	35.9	950	37.9

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																	
	3.00		3.25		3.50		3.75		4.00		4.25		4.50		4.75		5.00	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
20,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26,000	798	20.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28,000	812	21.9	835	23.6	858	25.3	—	—	—	—	—	—	—	—	—	—	—	—
30,000	831	23.8	851	25.4	874	27.2	896	29.1	917	30.9	—	—	—	—	—	—	—	—
32,000	851	26.0	871	27.6	890	29.3	910	31.0	931	32.9	952	34.9	972	36.8	992	38.8		

Table 16 — Fan Performance (Air Foil) — 48/50MP90P*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																	
	0.50		0.75		1.00		1.25		1.50		1.75		2.00		2.25		2.50	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
24,000	501	5.70	534	6.78	565	7.89	594	9.05	622	10.2	649	11.5	674	12.7	702	14.1	729	15.6
26,000	531	8.78	581	7.93	591	9.12	619	10.3	646	11.6	672	12.9	696	14.2	720	15.5	745	17.0
28,000	561	7.98	588	9.20	617	10.5	644	11.7	669	13.1	695	14.4	719	15.8	742	17.2	764	18.6
30,000	591	9.36	618	10.6	644	12.0	670	13.3	695	14.7	718	16.1	742	17.8	765	19.1	787	20.6
32,000	621	10.6	645	12.2	670	13.6	695	15.0	719	16.5	742	18.0	764	19.5	787	21.0	806	22.6
34,000	651	12.5	676	13.9	698	15.4	721	16.9	744	18.4	767	20.0	789	21.5	810	23.1	831	24.8
36,000	681	14.3	704	15.8	727	17.3	748	18.9	770	20.5	792	22.1	813	23.8	833	25.4	853	27.1
38,000	713	16.3	735	18.0	758	19.6	777	21.2	797	22.9	818	24.6	839	26.3	856	28.0	878	29.8
40,000	743	18.5	763	20.1	785	21.8	805	23.5	824	25.3	843	27.0	863	28.8	883	30.6	902	32.5
42,000	774	20.9	794	22.5	814	24.4	834	26.2	853	28.0	871	29.8	889	31.7	908	33.5	927	35.3
44,000	806	23.5	825	25.4	844	27.2	863	29.1	882	31.0	900	32.9	917	34.8	934	38.7	953	38.7
46,000	837	26.3	856	28.2	874	30.2	892	32.1	910	34.1	928	36.0	945	38.0	961	40.0	978	42.1

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																	
	3.00		3.25		3.50		3.75		4.00		4.25		4.50		4.75		5.00	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
24,000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26,000	795	20.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28,000	810	21.7	833	23.4	856	25.1	—	—	—	—	—	—	—	—	—	—	—	—
30,000	828	23.6	849	25.2	871	27.0	893	28.8	915	30.7	—	—	—	—	—	—	—	—
32,000	849	25.8	859	27.4	888	29.1	907	30.8	928	32.7	949	34.6	969	36.6	969	38.8	—	—
34,000	871	28.1	890	29.8	909	31.6	927	33.3	945	35.0	963	36.9	983	38.9	1003	41.0	1022	43.0
36,000	893	30.6	912	32.4	930	34.2	948	36.0	966	37.8	983	38.9	1000	41.5	1017	43.4	1036	45.6
38,000	916	33.4	935	35.2	953	37.1	971	39.0	988	40.0	1005	42.8	1022	44.7	1038	46.7	1054	48.6
40,000	939	36.2	956	38.1	974	40.0	992	42.0	1009	43.9	1025	45.9	1042	44.9	1058	49.9	1074	52.0
42,000	963	39.3	980	41.3	997	43.3	1014	45.3	1031	47.3	1048	49.4	1064	51.5	1080	53.5	1095	55.6
44,000	988	42.7	1005	44.6	1022	45.6	1038	48.9	1054	51.0	1070	53.1	1086	55.2	1102	57.4	1118	59.6
46,000	1013	46.2	1029	48.4	1046	50.5	1062	52.6	1077	54.8	1093	56.9	1108	59.1	1124	61.4	1139	63.6

LEGEND

Bhp — Brake Horsepower

*Refer to Fan Performance, 48MP Units section, for correct procedure on 48MP units.

NOTES:

1. Fan performance is based on wet coils and clean 2-in. filters.
2. Conversion — Bhp to kW:

$$\text{kW} = \frac{\text{Bhp} \times .746}{\text{Motor efficiency}}$$

See Table 1 for motor efficiency.

Table 17 — Fan Performance (Air Foil) — 48/50MP10R*

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																	
	0.50		0.75		1.00		1.25		1.50		1.75		2.00		2.25		2.50	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
26,000	525	6.55	555	7.69	585	8.88	613	10.1	641	11.3	667	12.6	692	13.9	715	15.3	739	16.7
28,000	554	7.69	582	8.90	610	10.2	637	11.4	663	12.7	689	14.1	713	15.5	736	16.9	759	18.3
30,000	584	9.00	611	10.3	636	11.6	663	13.0	688	14.3	712	15.7	735	17.2	758	18.7	781	20.2
32,000	613	10.4	639	11.8	663	13.2	688	14.6	712	16.1	736	17.5	763	19.0	780	20.6	802	22.1
34,000	643	12.0	667	13.5	691	14.9	714	16.4	737	17.9	760	19.5	782	21.0	803	22.8	824	24.3
36,000	672	13.7	696	15.2	719	15.8	740	18.3	761	19.9	784	21.5	805	23.2	826	24.8	846	26.5
38,000	704	15.7	726	17.3	748	18.9	769	20.5	789	22.2	810	23.9	831	25.8	851	27.3	871	29.1
40,000	734	17.8	755	19.5	776	21.2	797	22.9	817	24.6	836	26.3	855	28.1	875	29.9	894	31.7
42,000	765	20.1	785	21.9	805	23.6	825	25.4	844	27.2	863	29.0	881	30.8	900	32.7	919	34.6
44,000	795	22.5	815	24.3	834	26.2	853	28.1	872	29.9	890	31.8	907	33.7	925	35.0	943	37.6
46,000	826	25.2	845	27.2	864	29.1	882	31.0	900	33.0	918	34.9	935	38.0	952	38.9	968	40.9
48,000	857	28.2	876	30.2	894	32.2	911	34.2	929	36.2	946	38.3	963	40.3	979	42.4	995	44.5
50,000	889	31.4	907	33.4	924	35.8	941	37.5	958	39.8	975	41.9	991	44.0	1007	46.1	1023	48.3
52,000	919	34.7	937	35.9	954	39.0	970	41.2	986	43.4	1003	45.6	1019	47.8	1035	50.0	1050	52.2

AIRFLOW (Cfm)	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)																	
	3.00		3.25		3.50		3.75		4.00		4.25		4.50		4.75		5.00	
	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp	Rpm	Bhp
26,000	790	19.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28,000	804	21.3	828	23.0	851	24.7	—	—	—	—	—	—	—	—	—	—	—	—
30,000	823	23.2	843	24.8	865	26.5	887	28.3	909	30.2	930	32.0	—	—	—	—	—	—

Table 18 — Component Pressure Drop (in. wg)

COMPONENT	22,000	26,400	30,000	34,000	38,000	42,000	45,800	48,200	52,000
HEAT EXCHANGER (48MP ONLY)	0.31	0.40	0.49	0.58	0.70	0.82	0.95	1.03	1.23

Table 19 — Maximum Allowable Supply Fan Wheel Speed (Rpm)

48/50MP	FAN TYPE	
	Forward Curved	Airfoil
62L, 70M	835	1595
82N, 90P, 10R	715	1298

Table 20 — Maximum Allowable Power Exhaust Fan Speed (Rpm)

48/50MP	FAN TYPE	
	50% Air	100% Air
62L, 70M	690	650
82N, 90P, 10R	600	560

Table 21 — Air Quantity Limits (cfm)

UNIT SIZE 48/50MP	MINIMUM	MAXIMUM	MINIMUM GAS HEATING (Low Heat Units) 48MPD	MINIMUM GAS HEATING (High Heat Units) 48MPE
62L	16,000	32,000	12,850	15,400
70M	18,000	36,000	12,850	15,400
82N	21,000	42,000	14,700	19,250
90P	23,000	46,000	14,700	19,250
10R	26,000	52,000	14,700	19,250

Controls Configuration and Quick Test

SUPPLY FAN STATUS SWITCH (FS) — A snap acting single-pole, double-throw (SPDT) differential pressure switch is factory mounted in the auxiliary control box. The switch senses the change in pressure across the supply-air fan and provides the fan status. A length of plenum tubing connects the switch to the probe located in the fan discharge box.

The switch must be set prior to unit operation. To set the switch, turn the adjustment screw on top (center) of switch clockwise to increase set point, or counterclockwise to decrease set point. The set point switch range is 0.05 to 2.0 in. wg with a deadband of 0.02 in. wg at minimum set point and 0.1 in. wg at maximum set point.

Set switch so that contact makes to NC when supply-air fan is energized. The switch should make (fan on) within 1 minute after supply-air fan is energized and break (fan off) within 1 minute after the fan is deenergized.

CHECK FILTER SWITCH (CFS) — A snap acting SPDT switch is factory mounted in the auxiliary control box. The switch senses the differential pressure and provides the microprocessor module with a signal for filter status. Two lengths of plenum tubing connect the switch to probes located both upstream and downstream of the unit filters.

The switch must be set prior to unit operation. To set the switch, turn the adjustment screw on top (center) of switch slowly clockwise to find the “pivot” point where the filter status still reads clean under **8 STAT** in the HSIO display. Check the switch operation with the supply-air fan running

and nominal cfm delivery. See Table 22 for clean filter pressure drops for help in locating the “pivot” point. Once this point is found, turn the screw clockwise to obtain the set point at which the filter status will be dirty. Use Table 22 as a guide.

Table 22 — Filter Switch Dirty Set Point

FILTER TYPE	INCREASED PRESSURE DROP TO “DIRTY” FROM PIVOT POINT	APPROXIMATE CLOCKWISE TURNS
2-in. Throwaway	0.30 in. wg	2
4-in. Pleated with 2-in. Throwaway	0.75 in. wg	5

ENTHALPY CONTROL SET POINT — The enthalpy sensor (See Fig. 45) is located behind the filters in the right side economizer hood and is accessed through the filter access door. For maximum benefit of outdoor air, set enthalpy sensor control to the A setting. At this setting, when the relative humidity is 50%, and the outdoor air is below 74 F, the sensor’s relay contacts will be closed. See Fig. 46 and 47.

NOTE: Enthalpy control setting dial is on the enthalpy control.

Economizer Damper Linkage Adjustment — When replacing economizer damper motors, or if the linkage has come loose, it is critical that the linkages be adjusted correctly. They are sensitive, and incorrect adjustment can cause the motor to stall. Check linkage for free movement and complete range of travel.

Minimum Position Set Point — Minimum economizer position is set using the keypad and display module. Refer to Control and Troubleshooting literature for more details.

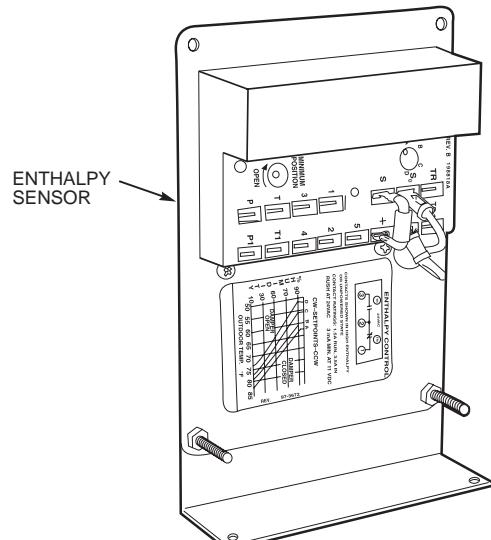


Fig. 45 — Enthalpy Sensor

CONTROL CURVE	CONTROL POINT (Approx Deg F) AT 50% RH
A	73
B	68
C	63
D	58

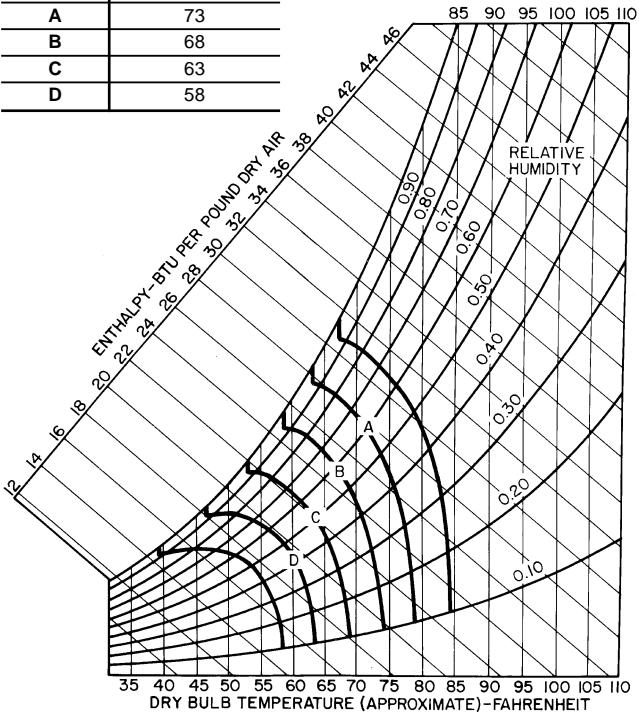
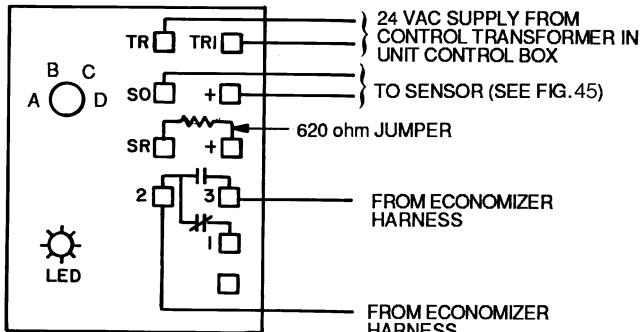


Fig. 46 — Psychrometric Chart for Enthalpy Control



NOTES:

- Switches shown in high enthalpy state. Terminals 2 and 3 close on enthalpy decrease.
- When standard economizer is used with accessory differential enthalpy sensor, set enthalpy control to "D" setting.

Fig. 47 — Wiring Connections for Solid-State Enthalpy Sensor (HH57AC077)

KEYPAD AND DISPLAY MODULE (HSIO) CONFIGURATION

IMPORTANT: The HSIO keypad and display module is required for initial start-up of these units. All units are shipped in standby mode, and the HSIO should be used to change the unit to run mode. Once the unit is in run mode, the HSIO is not required for normal operation.

The keypad and display module provides unit function information at the unit. See Fig. 48. The module consists of a keypad with 6 function keys, 5 operative keys, 10 numeric keys (0 through 9), and an alphanumeric 8-character liquid crystal display (LCD). Key usage is explained in Table 23. Each function has one or more subfunctions.

The HSIO keypad and display module is installed by connecting the power and communication plugs and can be easily moved from one unit to another. Because of this flexibility, one HSIO can be used for several units.

Unit operation is controlled by the status of the run/standby mode on the HSIO. To access the mode, press **1 1 STAT** on the HSIO keypad, and then press **▼**. The HSIO will display either STBY YES or STBY NO. To enable the unit, press **CLEAR** or **.** and press **ENTER** while at the STBY YES display. To disable the unit, press **1 ENTER** while at the STBY NO display. Clearing an alarm that has stopped unit operation is accomplished by entering the STBY YES mode.

IMPORTANT: Use the STBY YES mode when servicing the unit or running the quick test feature.

IMPORTANT: If remote start function is used, place LOCAL/REMOTE switch in Local (OFF) position whenever unit is placed in STBY YES.

SET UNIT TYPE — The correct unit type must be set. The default unit type is VAV. If the unit is being used in a VAV application, then the unit type does not need to be changed.

Table 23 — HSIO Keypad Key Usage

FUNCTION KEYS	USE
STAT	Status — To display diagnostic codes and current operating information about the unit.
TEST ALRM	Quick Test — To check inputs and outputs for proper operation.
HIST	History — To check most recent alarms.
SRVC	Service — To enter specific unit configuration information.
SET	Set Point — To enter operating set points and day/time information.
SCHD	Schedule — To enter occupied/unoccupied schedules for unit operation.
OPERATIVE KEYS	USE
EXPN EDIT	Expand Display — To display a non-abbreviated expansion of the display.
CLEAR	Clear — To clear the screen and return to previous display. Also used to enter data value of zero.
▲	Up Arrow — To return to previous display position.
▼	Down Arrow — To advance to next display position.
ENTER	To enter data.

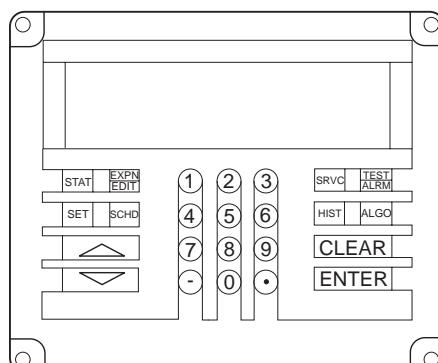


Fig. 48 — Keypad and Display Module (HSIO)

If the unit is being used in a CV application, then perform the following:

1. Enter the configuration function by pressing **3** and **SERV**.
2. Scroll down to unit type. TYPE 1 will be displayed.
3. Press **0** and **ENTER** to change the unit type to CV.
4. Scroll down to data reset. DTRS will be displayed. Press **1** and **ENTER** to save changes.

The fan operation type should also be configured for use in occupied time periods. Fan operation can be set to continuous or auto. To set, press **6 SRVC** to enter the subfunction. Scroll down to fan mode (FANM). Press **0** and **ENTER** to set to AUTO. Press **1** and **ENTER** to set to continuous.

ENTER JOB SET POINT VALUES — The set point function allows the user to view the current values set for the unit. From this function, the user can change the values.

Reading and Changing Set Points — To change the set point of a particular feature, enter the appropriate subfunction and scroll to the variable desired. Once the desired variable has been reached, type in the new value and press **ENTER**. The new value will appear in the display.

For example, the occupied cool set point is currently set at the default value of 78 F. To change the occupied set point to 72 F:

1. Press **1 SET** **▼▼** to enter the occupied cool set point function. The display will read OCSP 78.
2. Press **7 2 ENTER** and the display will read OCSP 72.

Set points can be changed by the user provided that the values are within the allowable range for the input. If the input is not within the allowable range, the original value will remain displayed. See Table 24 for allowable ranges and default values.

To change the demand limit set points, the functions must first be enabled in the field configuration subfunction.

CONFIGURE UNIT CONTROLS AND FUNCTIONS — Refer to Table 25 for a suggested sequence for entering Basic System Configuration data. These values may be changed from the HSIO at any time. If changing default values via the CCN, the 48/50MP unit must first be in run mode (STBY NO).

NOTE: After changing any of the values in the **3 SRVC** configuration group, enable the Data Reset function.

QUICK TEST FUNCTION — Enable and run the Quick Test function. Refer to the Controls and Troubleshooting manual for more information on Quick Test.

Table 24 — Set Point Ranges and Defaults

DISPLAY	SET POINT DESCRIPTION	DEFAULT VALUE	ALLOWABLE RANGE
BPS	Building pressure set point	0.05 in. wg	0 to .50 in. wg
ECSO*	Economizer set point offset	3	1 to 10
HHL†/HHOR*	High humidity override (percent)	99%	0 to 100%
HTMP	High temperature minimum position	35 F	0 to 100 F
HUSP	Humidity set point (percent)**	40%	0 to 100%
IAQS†	IAQ set point	650 ppm	0 to 2000 ppm
LIMT†	Reset limit (F)	10 F	0 to 20 F
LSP	Loadshed set point (percent)	50%	0 to 100%
LTMP	Low temperature minimum position	10 F	0 to 100 F
MDP†	Minimum damper position (percent)	20%	0 to 100%
NTLO†	NTFC lockout temperature (F)	50 F	40 to 70 F
OLST/OACS*	Outdoor-air cfm set point	1 cfm	0 to 50,000 cfm
OCSP	Occupied cool set point (F)**	78 F	55 to 80 F
OHSP	Occupied heat set point (F)**	68 F	55 to 80 F
PES†	Power exhaust on set point (percent)	90%	30 to 100%
RTIO†	Reset ratio (F)	3 F	0 to 10 F
SASP	Supply air set point (F)	55 F	45 to 70 F
SPSP	Static pressure set point††	1.5 in. wg	0 to 5.0 in. wg
UCDB*	Unoccupied cooling deadband	1	0 to 10
UCSP	Unoccupied cool set point (F)**	90 F	75 to 95 F
UHDB*	Unoccupied heating deadband	1	0 to 10
UHSP	Unoccupied heat set point (F)**	55 F	40 to 80 F

LEGEND

IAQ — Indoor-Air Quality
NFTC — Unoccupied Free Cooling
ppm — Parts Per Million

*These items are found under the Service function, and can only be accessed using either the Building Supervisor or Service Tool.

†These items are found under the Service function.

**Occupied space.

††Supply duct.

NOTE: Set points HHL/HHOR and OCS/OACS are displayed differently on the HSIO and Building Supervisor. The set points are shown as HHL and OCS on the HSIO. The set points are shown as HHOR and OACS on Building Supervisor or Service Tool.

Table 25 — Basic Configuration Data

SET POINT	SUBFUNCTION	DISPLAY	DEFAULT	RANGE
Unit Type	<input type="checkbox"/> 3 <input type="checkbox"/> SRVC	TYPE	1 = VAV	CV = 0, VAV = 1
CV Fan Mode	<input type="checkbox"/> 6 <input type="checkbox"/> SRVC	FANM	1 (Continuous)	Auto = 0, Cont = 1
Economizer Minimum Damper Position	<input type="checkbox"/> 1 <input type="checkbox"/> 0 <input type="checkbox"/> SRVC	MDP	20 percent	0 to 100
Heating Occupied*	<input type="checkbox"/> 1 <input type="checkbox"/> SET	OHSP	68 (F)	55 to 80
Cooling Occupied	<input type="checkbox"/> 1 <input type="checkbox"/> SET	OCSP	78 (F)	55 to 80
Cooling Unoccupied	<input type="checkbox"/> 1 <input type="checkbox"/> SET	UCSP	90 (F)	75 to 95
Heating Unoccupied	<input type="checkbox"/> 1 <input type="checkbox"/> SET	UHSP	55 (F)	40 to 80
Static Pressure	<input type="checkbox"/> 1 <input type="checkbox"/> SET	SPSP	1.5 (in. wg)	0 to 5.0
Supply Air Temperature	<input type="checkbox"/> 1 <input type="checkbox"/> SET	SASP	55 (F)	45 to 70
Date and Time	<input type="checkbox"/> 3 <input type="checkbox"/> SET	TIME	dow.hh.mm mm.dd.yy	—
Override Schedule†	<input type="checkbox"/> 1 <input type="checkbox"/> SCHD	OVRD x HR	0 (hrs)	0, 1, 2, 3 or 4
Schedule I Periods	<input type="checkbox"/> 2 <input type="checkbox"/> SCHD	OCC HH.MM	—	—

LEGEND

CV — Constant Volume
VAV — Variable Air Volume

*Requires Occupied Heating function enabled.

†See text section for discussion and instructions.

Gas Pressure Check — Prior to performing the Quick Test, install gas pressure gages and jumper as follows:

1. Turn off manual gas stop valve.
2. Install a jumper between HR1-NO and HR2-NO.
3. Connect pressure gage to gas supply pressure tap. See Fig. 34.
4. Connect pressure gage to manifold pressure tap on each gas manifold.
5. Turn on manual gas stop valve.

During the heating portion of the Quick Test, 5 TEST, both the first and second stage of gas heat will be tested. During the first stage, all of the burner sections will operate at low fire condition (approximately 75% capacity). During the second stage, all of the burner sections will operate at 100% capacity.

During the Quick Test of stage 2, after the unit has been operating for several minutes, verify that the incoming gas line pressure is 5.5 in. wg or greater. Also, verify that the manifold pressure at each burner section is 3.3 in. wg. If manifold pressure must be adjusted, refer to the Gas Valve Adjustment section on page 52.

After the unit has been in operation for 5 minutes, check the temperature rise across the unit heat exchangers. See the unit informative plate for correct rise range limits. Air quantities may need to be adjusted to bring the actual rise within allowable limits.

IMPORTANT: After the Quick Test has been performed for stage 2, remove the jumper between HR1-NO and HR2-NO.

Check Supply Fan Rotation — If unit is equipped with an optional VFD, check for correct fan rotation. Fan direction can be changed by disconnecting power and switching 2 power leads downstream of the VFD output terminals T1, T2, and T3.

START-UP

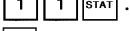
Initial Check

IMPORTANT: Do not attempt to start unit, even momentarily, until all items on the Start-Up Checklist and the following steps have been completed.

1. Verify unit has been installed per the Installation section of this literature.
2. Certify that all auxiliary components (sensors, controls, etc.) have been installed and wired to the control boxes per these instructions, the Controls and Troubleshooting literature and the unit wiring label diagrams.
3. Verify that pressure hoses (static, duct, etc.) are properly attached, routed, and free from pinches or crimps that may affect proper control operation.
4. Set any control configurations that are required (field-installed accessories, etc.). The unit is factory configured for all appropriate factory-installed options with the applicable controls programmed to the default values. See unit Controls and Troubleshooting literature for applicable configuration values.
5. Enter unit set points (if applicable). The unit is shipped with the set point default values shown in the Controls and Troubleshooting literature. If a different set point is required, change per the example shown under Set Point Function section in Controls and Troubleshooting literature.
6. Configure schedule subfunctions (if applicable): occupied, unoccupied, and holiday periods. See Schedule Function section in Controls and Troubleshooting literature for details on setting periods.
7. Verify that control time periods programmed meet current requirements.
8. Check all electrical connections to be sure they are tight.

General

NOTE: If unit is equipped with REMOTE START function, place the LOCAL/REMOTE switch in the LOCAL (Off) position.

1. Put the ON/OFF switch in the ON position. Close the control circuit breaker (CCB), which will energize the control circuit and the crankcase heaters.
2. Using the HSIO or Building Supervisor, verify that no alarms have been detected.
3. Ensure that quick test has been performed to make sure that the controls are operating properly. Refer to the Controls and Troubleshooting Guide for more information.
4. Using the HSIO, put the unit into Run mode.
 - a. Press .
 - b. Press .
 - c. Press .
 - d. Press . The unit will change from mode 25 (standby), to mode 32 (occupied) or mode 27 (unoccupied) depending on the programmed time schedule.

Operating Sequences — Base unit operating sequences are presented below. Refer to unit Controls and Troubleshooting literature for expanded details on unit controls operation, additional controls functions, and logic theory.

SUPPLY FAN

VAV Units — During Occupied periods, the control will energize the supply fan contactor. The contactor will close, energizing supply fan motor. Fan wheel will turn. Airflow Switch (differential pressure switch) contacts close, providing discrete input (DI) to Channel 12 (Closed = Fan ON). Fan operation will continue through the Occupied period.

During Unoccupied period with demand, the control will energize fan contactor when demand is sensed. After fan status is confirmed, operating routines will start. When demand is removed, routines will end and fan will shut off.

CV Units, Continuous Fan — During Occupied periods, the control will energize the supply fan contactor. The contactor will close, energizing supply fan motor. Fan wheel will turn. Airflow Switch (differential pressure switch) contacts close, providing discrete input (DI) to Channel 12 (Closed = Fan ON). Fan operation will continue through the Occupied period.

During Unoccupied period with demand, the control will energize fan contactor when demand is sensed. After fan status is confirmed, operating routines will start. When demand is removed, routines will end and fan will shut off.

CV Units, Automatic Fan — Fan will be turned OFF during Occupied period when there is no demand for heating or cooling operation. When demand is sensed, control will energize fan contactor and initiate cooling cycle. Fan status will be confirmed. When demand is removed, routines will terminate and fan will be shut off.

ECONOMIZER — The economizer control loop will be delayed 2 minutes after the supply fan is turned ON, to allow system and temperatures to stabilize before starting control. When coming out of STANDBY or Heating mode, a 4-minute delay will occur before the economizer damper is controlled. During this delay, damper position is limited to CLOSED or MINIMUM position (depending on current unit occupancy status).

If fan status is OFF, the outside air dampers will remain closed (return air dampers will be open). If fan status is ON, the outside air dampers will normally be at minimum damper position.

Economizer operation is permitted if the system is not in Heating mode, if outdoor air enthalpy (via switch or humidity differential) is acceptable, and if outside air temperature is less than space temperature.

If economizer operation is permitted, the ecomizer control loop checks for Cooling System operation. If ON, the outside air dampers will be driven to maximum position.

If cooling is not on, for VAV units, the economizer will modulate to satisfy the supply air set point.

If cooling is not on, for CV units, the economizer will modulate to satisfy the space temperature set point.

If Economizer operation is not permitted, the outside air dampers will be driven to minimum position (during Occupied period) or closed (during Unoccupied period).

For VAV units, Economizer operation is not permitted when Occupied Heating is enabled and the Return Air Temperature is LESS THAN (OHSP + 1).

COOLING (All Units) — The controls try to control the supply-air temperature (SAT) to a system-calculated coil reference temperature value by cycling the compressors and the unloader(s). Both the supply- and return-air temperature sensors are used to adjust the cycling deadband to match the actual load. The control system provides cooling capacity control of up to 11 stages to maintain supply-air temperature (VAV) or space temperature (CV) to an occupied or unoccupied set point. Automatic lead-lag circuit switching occurs (if configured) to equalize run times per compressor for improved compressor reliability. The compressor to start first is changed every time stage equals zero.

NOTE: Automatic lead/lag should be disabled if optional hot gas bypass is employed because the unit only contains hot gas bypass on one circuit.

The VAV control system sequence uses the modified supply-air set point (MSAT = supply-air set point + reset value) as the supply-air temperature required to satisfy conditions (submaster reference value [CCSR]) and outputs this value to the submaster loop.

The submaster loop uses the modified supply-air set point compared to the actual supply-air temperature to determine the required number of capacity stages to satisfy the load. The logic for determining when to add or subtract a stage is a time-based integration of the deviation from the set point plus the rate of change of the supply-air temperature.

The CV control system sequence reads the space sensor and performs a calculation to determine the supply-air temperature required (a cooling coil submaster reference [CCSR] value) to satisfy conditions and outputs this value to the submaster loop.

OCCUPIED COOLING

General — Economizer cycle must not be usable or damper position must be open to 90% or higher.

VAV Units — Supply fan must be ON for cooling control to operate. Sequence is as follows:

1. Unit must not be in Heating mode.
2. Master Loop will survey occupancy status, Supply Air Set Point (SASP) and any Supply Air Temperature Reset command, then issue Cooling Coil Submaster Reference (CCSR) to Cooling Submaster Loop (CSL).
3. The CSL surveys actual SAT, then calculates number of capacity stages required to produce the CCSR leaving the unit.
4. Stages of cooling capacity are initiated. From zero stages, there will be a 1.5 to 3 minute delay before the first stage is initiated. The time delay between stages in increasing demand is 90 seconds.

5. As actual SAT approaches CCSR value, stages are released. The minimum time delay between stages on decreasing demand is 90 seconds.

NOTE: Demand for heating has priority and Master Loop will either terminate existing or prevent initiation of Cooling Cycle by issuing a CCSR at the maximum limit. This will cause the CSL to select zero stages of cooling capacity, initiating a stoppage of an existing cooling cycle.

CV Units — Supply fan must be ON for cooling control to operate. Sequence is as follows:

1. Master Loop will survey space temperature and space temperature offset inputs, then calculate CCSR value.
2. The CSL surveys actual SAT, then calculates number of capacity stages required to satisfy space load.
3. Stages of cooling capacity are initiated. (From zero stages, there will be a 1.5 to 3 minute delay before first stage is initiated.)

UNOCCUPIED COOLING — The unoccupied cooling sequence of operation is similar to Occupied Cooling (see above) except for the following:

1. Supply Fan will be OFF as demand is initiated.
2. The Master Loop will start Supply Fan and cooling cycle. Fan status must be proved as ON within 2 minutes to continue with cooling operation.
3. Control set point will be Unoccupied Cooling Set Point (UCSP).
4. At end of cooling cycle, Supply Fan will be turned OFF.

OVERRIDES

First Stage and Slow Change Override — The first stage override reduces cycling on the first stage of capacity, and the slow change override prevents the addition or subtraction of another stage of capacity if the SAT is close to the set point and gradually moving towards the set point.

Low Temperature Override — This override function protects against rapid load decreases by removing a stage every 30 seconds when required based on temperature and the temperature rate of change.

High Temperature Override — This override function protects against rapid load increases by adding a stage once every 60 seconds as required, based on temperature and temperature rate of change.

ADAPTIVE OPTIMAL START — Optimal start is used to heat up or cool down the space prior to occupancy. The purpose is to have the space temperature approach and then achieve the occupied set point by the time of occupancy. The control utilizes outdoor-air temperature, space temperature, occupied set point, and a "K" factor. The "K" factor is expressed in minutes per degree, and calculates a start time offset, which is the time in minutes that the system shall be started in advance of the occupied time. The control monitors its results and adjusts the "K" factor to ensure that the occupied set point is achieved at time of occupancy rather than too early or too late.

ADAPTIVE OPTIMAL STOP (CV Applications Only) — Optimal stop is used to allow space temperature to drift to an expanded occupied set point during the last portion of an occupied period. The control calculates a stop time offset, (the time in minutes prior to the scheduled unoccupied time) during which expanded heating and cooling set points can be used. Adaptive optimal stop utilizes space temperature, an expanded occupied set point, and a "K" factor to calculate stop time offset. The amount (F) to expand the occupied

set point is user configurable. Like adaptive optimal start, the control corrects itself for optimal operation by adjusting the "K" factor as required.

GAS HEATING, OPERATION (48MP Units Only) — Refer to the Controls, Operation and Troubleshooting instructions for information on the control logic used by the unit controls for gas heat operation.

The 48MPD units have 2 gas heat sections. The 48MPE units have 3 gas heat sections. Each individual section operates in the same manner.

NOTE: The 48MP units have 2 stages of heat.

When the PIC control calls for heating, power is sent to W on each IGC (integrated gas controller) board. An LED (light-emitting diode) on the IGC board will be on during normal operation. A check is made to ensure that the rollout switch and the limit switch are closed and the induced-draft motor is not running. The induced-draft motor is then energized, and when speed is proven with the hall effect sensor on the motor, the ignition activation period begins. The burners will ignite within 5 seconds.

If the burners do not light, there is a 22-second delay before another 5-second attempt. If the burners still do not light, this sequence is repeated for 15 minutes. After the 15 minutes have elapsed, if the burners have not been lit, heating is locked out. To reset the control, use the manual reset method found in the Controls Operation and Troubleshooting book.

When ignition occurs the IGC board will continue to monitor the condition of the rollout and limit switches, the hall effect sensor, and the flame sensor.

When additional heat is required, W2 closes and initiates power to the second stage of the main gas valve. When the thermostat is satisfied, W1 and W2 open and the gas valve closes, interrupting the flow of gas to the main burners. If the call for W1 lasted less than 1 minute, the heating cycle will not terminate until 1 minute after W1 became active.

An LED indicator is provided on the IGC to monitor operation. The IGC is located by removing the side panel and viewing the IGC through the view port located in the control box access panel. During normal operation, the LED is continuously on. See Table 26 for error codes.

Table 26 — IGC Control Board LED Alarms

INDICATION	ERROR MODE
ON	Normal Operation
OFF	Hardware Failure
1 FLASH	Fan ON/OFF Delay Modified
2 FLASHES	Limit Switch Fault
3 FLASHES	Flame Sense Fault
4 FLASHES	4 Consecutive Limit Switch Faults
5 FLASHES	Ignition Lockout Fault
6 FLASHES	Induced Draft Motor Fault
7 FLASHES	Rollout Switch Fault
8 FLASHES	Internal Control Fault

LEGEND

IGC — Integrated Gas Unit Controller
LED — Light-Emitting diode

NOTES:

1. There is a 3-second pause between error code displays.
2. If more than one error code exists, all applicable error codes will be displayed in numerical sequence.
3. Error codes on the IGC will be lost if power to the unit is interrupted.

Control Loop Checkout

⚠ CAUTION

The checkout and adjustment of control loops should only be done by certified Carrier Comfort Network (CCN) technicians. The following checkout procedure is offered as a guide and presumes the user has obtained basic knowledge of controls through CCN training.

TO CHECK OPERATION OF ANALOG OUTPUTS — The control algorithms of the unit controls utilize the master/submaster loop concept. The master loop monitors the master sensor (the sensor which tries to maintain the desired set point), and calculates the submaster reference required to do so. The submaster loop monitors the submaster sensor and controls the actual output to the controlled device.

These algorithms require the adjustment of a number of gain values to function properly. The 48/50MP units come with preset default values. However, it may be necessary to adjust several of these values to achieve stable control. These values are submaster loop gain (SMG), submaster loop center value (SCV), and master loop gain (MLG). In addition, proportional, integral, and derivative multiplier values can be accessed through the Building Supervisor, Service Tool, or ComfortWorks™ software.

To verify or adjust submaster default values, perform the following for each controlled device (control loop):

1. Verify that the system is in the Occupied mode and the supply-air fan is running.
2. Verify that the supply-air fan status indicates ON. If the fan status is OFF, the unit control algorithms will disable all routines.
3. Verify that all forced values have been removed.
4. Table 27 indicates recommended starting values for MLG and SMG for 48/50MP units. Verify that these values have been entered by checking the service function.

5. Verify/adjust the SMG. If the SMG is too large, the loop will tend to oscillate (hunt). If it is too small, the loop will react too slowly.

Verify or adjust the SMG as follows:

Using the HSIO keypad, force the submaster reference of the control loop to a value above or below the actual sensor reading. Verify that the actuator responds correctly. If the actuator drives in the wrong direction, go to the submaster gain (SMG) for the control loop and reverse the sign of the gain.

For example: If the submaster loop gain is 5.0, change it to -5.0.

6. Observe the operation of the controlled device for a few minutes. If the device oscillates every few seconds around the forced value, then lower the SMG by small amounts until the output steadies. If the output to the device responds to a change in the temperature in small increments, then increase the SMG in small amounts until the output steadies.

NOTE: Do not be alarmed if the submaster sensor stabilizes at a value greater or less than the forced value. This is called the submaster droop offset and is normal.

7. It is not necessary to adjust the submaster loop center value, as the master loop will adjust the submaster reference as required to satisfy its set point. However, it may be desirable to keep the submaster droop to a minimum. This is most often required for economizer loops. If the submaster droop is too large, adjust the SCV as follows:

If the submaster droop is positive (actual value greater than reference value), the SCV should be decreased for HCV (heating coil) and IGV (supply fan VFD) loops and increased for CC (cooling control) and ECON (economizer) loops.

If the submaster droop is negative (actual value less than reference value), the SCV should be increased for HCV and IGV loops and decreased for CC and ECON loops.

Table 27 — 48/50MP Units SMG, SCV and MLG Recommended Starting Values

FUNCTION/GAIN OR SCV	SERVICE SUBFUNCTION (HSIO)	GAIN VALUE	
		CV Application	VAV Application
Cooling Control MLG	8	1.0	1.0
Economizer MLG SMG SCV	10 10 10	1.0 -7.5 50	1.0 -7.5 50
Duct Pressure (VFD) MLG SMG SCV	9 9 9	N/A N/A N/A	1.0 2.0* 35*
Building Pressure MLG SMG SCV	18 18 18	1.0 -5.0 50	1.0 -5.0 50
Staged Heat MLG † SMG †	11 11	1.0 5.0	1.0 5.0
Heating Coil MLG SMG SCV	7 7 7	1.0 7.5 50	1.0 7.5 50
Humidifier MLG SMG SCV	17 17 17	1.0 7.5 50	1.0 7.5 50

*Factory setting; differs from new control setting.
†48MP only.

LEGEND

CV	— Constant Volume
MLG	— Master Loop Gain
SCV	— Submaster Center Value
SMG	— Submaster Loop Gain
VAV	— Variable Air Volume

8. Once the submaster loop is adjusted, remove all forced values and proceed with verification and adjustment of master loop.
9. To check the master loop:
Create a demand in the master loop. For example: Force the actual space temperature to a value less than the heating set point or greater than the cooling set point.
10. Observe system (loop) response for 10 to 20 minutes to verify stable control. After 10 minutes, if the output continues to swing from full open to full closed, lower the MLG and observe again.
11. Do this until the loop operation is stable. After 10 minutes, if the loop does not seem to respond (little change in submaster reference), increase the MLG and observe again. Do this until stable operation is achieved.
12. Once satisfied with loop operation, remove all forced values which may have been initiated during this procedure.
13. Repeat Steps 1-12 until all loops have been checked.

NOTE: For better tuning, the building supervisor or service tool should be used to adjust the proportional and integral terms. Contact your Carrier representative for more details.

IAQ Control Loop Adjustment — The IAQ (indoor air quality) control loop is different from the other control loops. It has one gain value that can be adjusted in the service subfunction (**1** **6**) under IAQG (indoor-air quality gain). This gain is used to speed up or slow down the response of the economizer dampers to the difference between the IAQ set point and the IAQ sensor. If the economizer is moving too slowly, then the gain needs to be increased. If the economizer moves too rapidly and overshoots the set point, then the gain should be reduced.

Lead/Lag Circuits — Lead/lag circuits and compressors are shown in Table 20.

Table 29 — Index of Lead/Lag Circuits and Compressors

UNIT 48/50MP	62L	70M	82N, 90P, 10R
LEAD CIRCUIT	A	A	A
Compressor, Lead	A1	A1	A1
Compressor, Lag	*	A2	A2
LAG CIRCUIT	B	B	B
Compressor, Lead	B1	B1	B1
Compressor, Lag	*	*	B2

*Circuit only has 1 compressor.

Final Checks — Ensure all safety controls are operating, control panel covers are on, and the service panels are in place.

Recheck all set points against project specifications. Complete Start-Up Checklist and record operating values. Leave completed checklist with unit for future reference.

NOTE: If the REMOTE START function is used in this application, set the LOCAL/REMOTE switch to REMOTE (On) at the end of start-up.

CONTROL SYSTEM

General — The control system consists of the following components:

- standard processor module (PSIO 8088 or PSIO1)
- options processor module (PSIO 8052 or PSIO2)
- two standard high-voltage relay modules (DSIO-HV or DSIO1 and DSIO2)
- keypad and display module (HSIO or LID)
- enthalpy sensor
- thermistors
- pressure transducers
- accessory humidity sensors
- space temperature sensors (standard T55 and accessory T56)
- supply-air fan status switch
- check filter switch

Components

PROCESSOR MODULE NO. 1 — The PSIO1 module monitors and processes the following inputs, outputs, and system information:

Inputs:

- transducers
- thermistors
- switches

Outputs:

- condenser-fan contactors
- integrated economizer motor (4 to 20 mA)
- optional supply duct static pressure control (VFD) (4 to 20 mA)
- optional modulating power exhaust control (VFD) (4 to 20 mA)

System Information:

- generates alert and alarm information (via transducer, thermistor, and sensor inputs)
- supports CCN level II communications
- supports digital air volume (DAV) interface

NOTE: The correct module address for the PSIO1 is 01 (S1 set at 0; S2 set at 1).

PROCESSOR MODULE NO. 2 — The PSIO2 module supports the sensors used for:

- humidity control
- outdoor-air cfm
- indoor-air quality (IAQ)
- smoke control
- superheat monitoring (only when accessory transducer thermistor kit is field-installed).

In addition, the PSIO2 supplies the outputs for humidity and hydronic heating coil control and a discrete output with timed clock control (for outdoor building or parking lot lights).

NOTE: The correct module address for the PSIO2 is 31 (S1 set at 3; S2 set at 1).

HIGH-VOLTAGE RELAY MODULES (DSIO) — The DSIO modules close contacts to energize evaporator and condenser fan contactors. The modules also control compressor unloaders, compressor contactors, compressor crankcase heaters, heat interlock function, and power exhaust contactor. The compressor status through the compressor lockout (CLO) relays and high-pressure switches (safety circuits) are the inputs to these modules.

NOTE: The correct module addresses for the DSIO1 and DSIO2 modules are 19 and 49, respectively. Set the switch closest to the mounting plate at 1 (DSIO1) or 4 (DSIO2), and the other switch at 9 (both modules).

KEYPAD AND DISPLAY MODULE (HSIO)

IMPORTANT: The HSIO (human sensor input/output) keypad and display module is required for initial start-up of these units. All units are shipped in standby mode, and the HSIO must be used to change the unit to run mode. Once the unit is in run mode, the HSIO is not required for normal operation.

The keypad and display module HSIO (or local interface device, LID, factory-installed and located in the main control box) provides unit function information at the unit. The module consists of a keypad with 6 function keys, 5 operative keys, 10 numeric keys (0 through 9), and an alphanumeric 8-character liquid crystal display (LCD). Key usage is explained in Table 23. Each function has one or more subfunctions as shown in Table 29.

The HSIO keypad and display module is installed through connection of the power and communication plugs and can be easily moved from one unit to another. Because of this flexibility, one HSIO can be used for several units.

Unit operation is controlled by the status of the RUN/STANDBY mode on the HSIO. To access the mode, press

[1] [1] STAT on the HSIO keypad, and then use the **▼** key. The HSIO will display either STBY YES or STBY NO. To enable the unit, press **CLEAR** or **.** and press **ENTER** while at the STBY YES display. To disable the unit, press **[1] ENTER** while at the STBY NO display. Clearing an alarm that has stopped unit operation is accomplished by entering the **STBY YES** mode.

IMPORTANT: Use the STBY YES mode when servicing the unit or running the Quick Test feature.

IMPORTANT: If unit is also equipped with REMOTE START function, place LOCAL/REMOTE switch in LOCAL (Off) position when servicing or running Quick Test feature.

Default Set Points/Changing Set Points — Refer to Table 24 for factory default configuration and set point values.

Record any changes made during start-up and leave with unit for future reference.

These values may be changed from the HSIO keypad at any time. If changing values via Service Tool or CCN Building Supervisor, the unit must be in RUN mode (STBY NO), which is done through HSIO input or a Remote Start input. After changing the values in subfunction **[3] SHVC**, the Data Reset function must be enabled.

Motor Protection — Manual reset, calibrated trip, magnetic circuit breakers are provided for each compressor, supply fan motor, and optional exhaust fan motor.

Outdoor fan motor circuits are also protected by circuit breakers.

Refer to the Service section more information on servicing motors.

Variable Frequency Drive (VFD) — An optional VFD can be factory-installed and is used to modulate supply fan airflow to maintain duct static pressure on VAV applications.

A second VFD can be used to modulate exhaust fan airflow to maintain building pressure on units equipped with modulating power exhaust option.

The supply fan VFD is located in the auxiliary control compartment, on the left hand side of the unit, at the end of the supply fan section.

The modulating power exhaust VFD is located in the exhaust fan compartment, on the right hand side of the unit, at the return air end.

Control input to the supply fan VFD is provided by a 4 to 20 mA signal from the PSIO1 (Channel 16).

Control input to the exhaust fan VFD is provided by a 4 to 20 mA signal from the PSIO1 (Channel 15).

Set point control for the VFD is done through the HSIO or other network devices (subfunction **[6] SHVC**). Refer to the Controls and Troubleshooting manual for configuration instructions and sequence of operation.

The VFD has been programmed at the factory for 48/50MP applications. No further adjustments should be necessary at start-up.

A separate technical and service manual for the factory installed VFD is supplied with each unit. Refer to the VFD manual for more information on accessing and diagnosing the VFD controls.

DISPLAY AND KEYPAD — All functions of the VFD are accessed using the Digital Operator. See Fig. 49. The Digital Operator has a 4-digit LED display. By pressing the **DSPL** key on the Digital Operator while the drive is stopped, the user can step to each of the 16 functions and displays. See Table 30.

Table 29 — HSIO Keypad and Display Module Functions and Subfunctions

SUB FUNCTION NO.	FUNCTIONS					
	STATUS <input type="button" value="STAT"/>	HISTORY <input type="button" value="HIST"/>	SCHEDULE <input type="button" value="SCHD"/>	SERVICE <input type="button" value="SRVC"/>	SET POINT <input type="button" value="SET"/>	TEST <input type="button" value="TEST ALRM"/>
1	Current Alarms	Alarms	Occupied Mode Override (Unit)	Log on and Log off	System Set Point	Test of Inputs
2	Current Alerts	Maintenance	Period 1 (Unit)	Software Version	Demand Limit	Analog Outputs
3	Current Operating Modes	—	Period 2 (Unit)	Factory Configuration	Current Time	Discrete Outputs
4	Capacity Stages	—	Period 3 (Unit)	Bus Address	Daylight Savings Time	Test Compressors
5	Current Operating Set Points	—	Period 4 (Unit)	Units of Measure	Configure Holiday	Test Heat
6	System Temperatures	—	Period 5 (Unit)	User Configuration	—	Exit Test
7	System Pressures	—	Period 6 (Unit)	Heating Coil	—	—
8	Inputs	—	Period 7 (Unit)	Cooling	—	—
9	Analog Outputs	—	Period 8 (Unit)	Duct Pressure	—	—
10	Discrete Outputs	—	Occupied Mode Override (TDO)	Economizer	—	—
11	Run/Standby	—	Period 1 (TDO)	Heat	—	—
12	—	—	Period 2 (TDO)	Nighttime Free Cool	—	—
13	—	—	Period 3 (TDO)	Adaptive Optimal Start/Stop	—	—
14	—	—	Period 4 (TDO)	Temperature Reset	—	—
15	—	—	Period 5 (TDO)	Configure Loadshed	—	—
16	—	—	Period 6 (TDO)	Configure IAQ	—	—
17	—	—	Period 7 (TDO)	Configure Humidity	—	—
18	—	—	Period 8 (TDO)	Building Pressure	—	—
19	—	—	—	Alert Limits	—	—
20	—	—	—	Service History	—	—
21	—	—	—	Service Maintenance Alarm	—	—
22	—	—	—	Override History	—	—

LEGEND

IAQ — Indoor-Air Quality
 TDO — Timed Discrete Output

Table 30 — Variable Frequency Drive (VFD) Display

DISPLAY	ACTION
Fref	Not used.
Fout	Displays the output frequency at which the VFD is currently operating. This is a display only function. The user cannot change this displayed value.
Iout	Displays the level of output current that the VFD is currently producing. This is a display only function. The user cannot change this displayed value.
kWout	Displays the output power that the VFD is currently producing. This is a display only function. The user cannot change this displayed value.
F/R	Sets the rotation direction of the motor when a run command is given.
Montr	Press ENTER to access the monitor parameters (U-01 through U-13).
Accel	Not used.
Decel	Not used.
Vmtr	Sets the rated voltage of the motor.
V/F	Sets a preset V/f pattern or allows a custom V/f pattern to be set.
Fgain	Sets the frequency reference gain for the analog frequency reference.
Fbias	Sets the frequency reference bias for the analog frequency reference.
FLA	Sets the full load amps used for detecting motor overload. When FLA is set to 0 it is disabled.
PID	Enables or disables the PID.
kWsav	Enables or disables the energy saving function.
PRGM	Allows parameter programming.

LEGEND

PID — Proportional Integral Derivative

REMOTE Mode indication LEDs.
The LEDs light when REMOTE Mode has been selected.

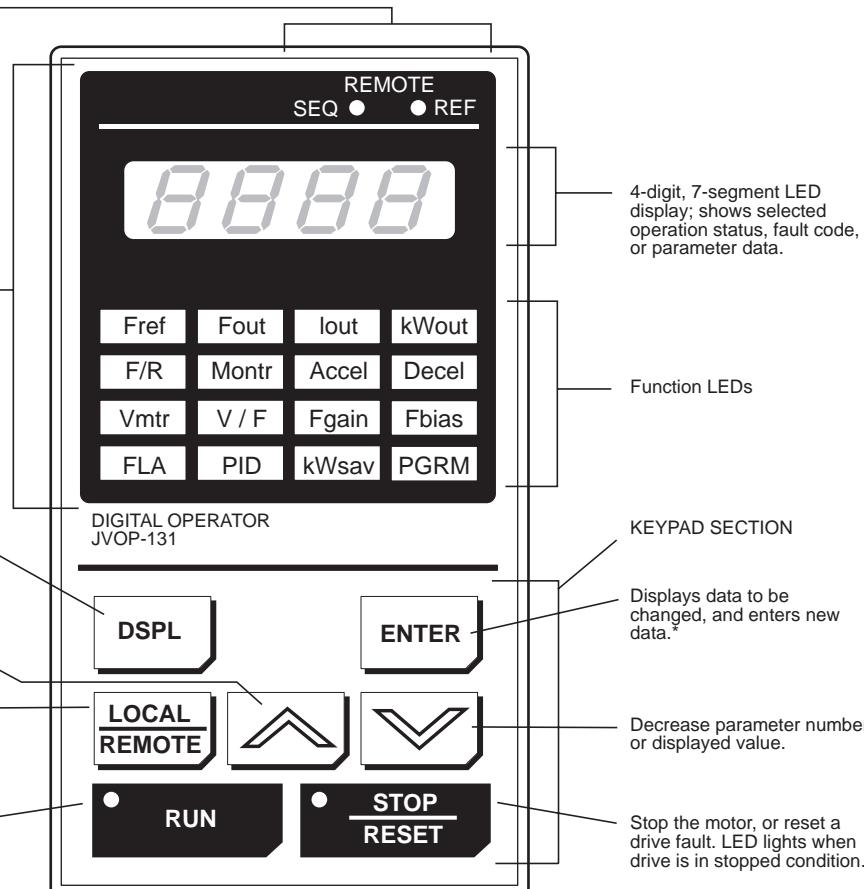
DISPLAY SECTION

Switch between Function LEDs*

Increase parameter number or displayed value.

Switch between LOCAL and REMOTE operation modes.

Run the motor. LED lights when drive is controlling motor speed.



*Pressing DSPL and ENTER keys simultaneously allows all parameter data to be read, but not set, while the drive is running.

SERVICE

Service Access — All unit components can be reached through clearly labeled hinged access doors. These doors are equipped with tiebacks, but if heavy duty servicing is needed, it is recommended that the doors be removed or propped open.

Each door is held closed with 3 latches. The latches are secured to the unit with a single 1/4-in. -20 x 1/2-in. long bolt. See Fig. 50.

To open, loosen the latch bolt using a 7/16-in. wrench. Pivot the latch so it is not in contact with the door. Open the door. To shut, reverse the above procedure.

NOTE: Disassembly of the top cover may be required under special service circumstances. It is very important that the orientation and position of the top cover be marked on the unit prior to disassembly. This will allow proper replacement of the top cover onto the unit and prevent rainwater from leaking into the unit.

IMPORTANT: After servicing is completed, make sure door is closed and relatched properly, and that the latches are tight. Failure to do this can result in water leakage into the indoor-air section of the unit.

Fig. 49 — VFD Digital Operator

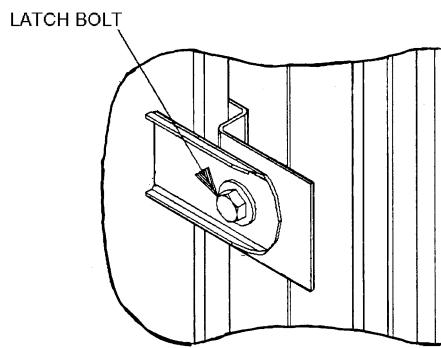


Fig. 50 — Door Latch

UNIT CONTROL BOX — Viewed facing compressors, the control box is at the left end of the unit. Incoming power for controls, refrigerant system, and fan system enters through the control box. The control box contains power components and electronic controls. Outer panels are hinged and latched for easy opening. Remove screws to remove inner panels. Outer panels can be held open for service and inspection by using a door retainer on each panel. Remove bottom pin from door retainer assembly, swing retainer out horizontally, and engage pin in one of the retainer ears in the hinge assembly.

COMPRESSORS — The oil pump end (compressor access) of each compressor is readily accessible from sides of unit as shown in Fig. 51. Access the motor end of the compressor through the condenser end of the unit or by removing compressor.

LIQUID SERVICE VALVES, SOLENOID VALVES, FILTER DRIERS, AND SIGHT GLASSES — These components are located in the inside corner of the condenser section on the right-hand side of the unit. Filter driers are replaceable-core type. See Fig. 51.

EVAPORATOR-FAN MOTORS, PULLEYS, AND BELTS — Access to these components is through the 2 doors labeled FAN SECTION on each side of the unit.

POWER EXHAUST MOTORS, PULLEYS, AND BELTS — Access to these components is through the doors at the return air end of the unit.

GAS HEAT SECTION — Access to the gas heat section is through the door labeled "HEAT SECTION" on the right hand side of the unit. All gas system components are in the gas section. On 48MP62L and 70M units, additional access to the gas components is through the access panels in the unit corner post at the gas section. See Fig. 51.

UNIT CONTROL BOX — Access to this component is through the doors marked ELECTRICAL SECTION on the condenser end of the unit.

ECONOMIZER DAMPER MOTORS — The economizer motors are located in the return air section. Access to the motors is through the doors labelled FAN SECTION on the each side of the unit.

RETURN-AIR FILTERS — Access to these filters is through the door marked FILTER SECTION on the right side of the unit.

CONDENSER FANS AND FAN MOTORS — Remove the wire fan guard on top of the unit to gain access to the condenser fans and motors.

Cleaning — Inspect unit at the beginning of each heating and cooling season and during each season as operating conditions may require.

Clean condenser coil with a vacuum cleaner, fresh water, compressed air, or a bristle brush (not wire). Coil cleaning should be a part of the planned maintenance program. Clean evaporator coil with a stiff bristle brush (not wire), vacuum cleaner, or compressed air.

Check and clean condensate drain annually at the start of the cooling season.

Replace return-air filters at the start of each heating and cooling season or as often as necessary during each season, depending on operating conditions. See Table 1 for filter types, quantities, and sizes.

1. Remove economizer outdoor-air filters from the hoods by removing the filter retainers.
2. Clean filters with steam or hot water and mild detergent.
3. Reinstall filters in hoods after cleaning. Never replace cleanable filters with throwaway filters.

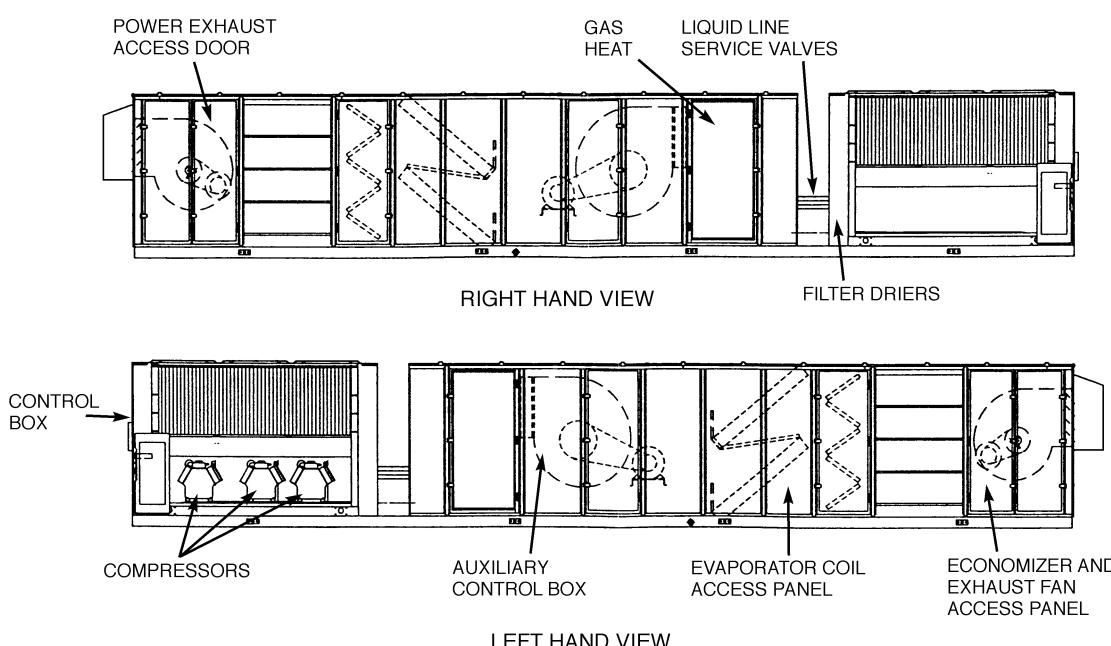


Fig. 51 — Access Locations (48MP70M Unit Shown)

MAIN BURNERS (48MP Only) — At the beginning of each heating season, inspect for deterioration or blockage due to corrosion or other causes. Observe the main burner flames. Refer to Main Burners section on page 52.

FLUE GAS PASSAGEWAYS (48MP Only) — The flue collector box and heat exchanger cells may be inspected by removing heat exchanger access panel (Fig. 3 and 4), flue box cover, and main burner assembly (Fig. 52). Refer to Main Burners section on page 52 for burner removal sequence. If cleaning is required, remove heat exchanger baffles and clean tubes with a wire brush.

Use caution with ceramic heat exchanger baffles. When installing retaining clip, be sure the center leg of the clip extends inward toward baffle. See Fig. 53.

COMBUSTION-AIR BLOWERS (48MP Only) — Clean periodically to assure proper airflow and heating efficiency. Inspect blower wheel every fall and periodically during heating season. For the first heating season, inspect blower wheel bi-monthly to determine proper cleaning frequency.

To inspect blower wheel, remove heat exchanger access panel. Shine a flashlight into opening to inspect wheel. If cleaning is required, remove motor and wheel assembly by removing screws holding motor mounting plate to top of combustion fan housing (Fig. 54). The motor and wheel assembly will slide up and out of the fan housing. Remove the blower wheel from the motor shaft and clean with a detergent or solvent. Replace motor and wheel assembly.

Lubrication

COMPRESSORS — Each compressor is correctly charged at the factory. Refer to 06E Compressor Service Manuals if additional information regarding compressor lubrication system is required. See Compressor Oil section on page 29 and Table 3.

FAN SHAFT BEARINGS — Lubricate fan shaft bearings at least once a year with suitable bearing grease. Extended grease lines are provided on pulley side of blower. Typical lubricants are given below:

MANUFACTURER	LUBRICANT
Texaco	Regal AFB-2*
Mobil	Mobilplex EP No. 1
Sunoco	Prestige 42
Texaco	Multifak 2

*Preferred lubricant because it contains rust and oxidation inhibitors.

FAN MOTOR BEARINGS — The condenser- and evaporator-fan motors have sealed bearings so no field lubrication is required.

DOOR HINGES — All door hinges should be lubricated at least once a year.

Coil Cleaning — Clean the coils with a vacuum cleaner, compressed air, water, or a non-wire bristle brush.

Refrigerant Circuit

LEAK TESTING — Units are shipped with a full operating charge of R-22 (see Table 1). If there is no pressure in the system, introduce enough nitrogen to search for the leak. Repair the leak using good refrigeration practices. After leaks are repaired, system must be evacuated and dehydrated using methods described in GTAC II, Module 4, System Dehydration.

REFRIGERANT CHARGE (Refer to Table 1) — At the liquid line connection point on each circuit is a factory-installed liquid line service valve. On each valve is a $\frac{1}{4}$ -in. Schrader connection for charging liquid refrigerant.

All units are shipped with a complete operating charge of R-22. See unit nameplate and Table 1 for amount of charge. When adding a complete charge, evacuate system using standard evacuating procedures and weigh in the specified amount of charge. All units have charging charts for each refrigerant circuit. See Fig. 55-59.

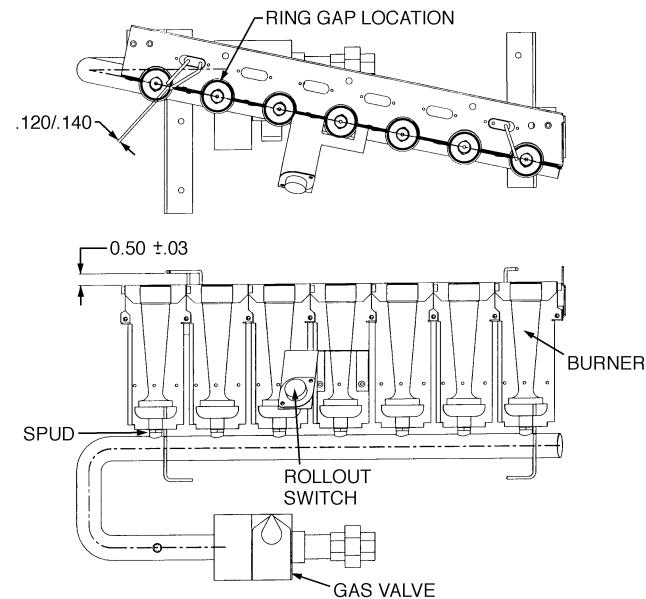
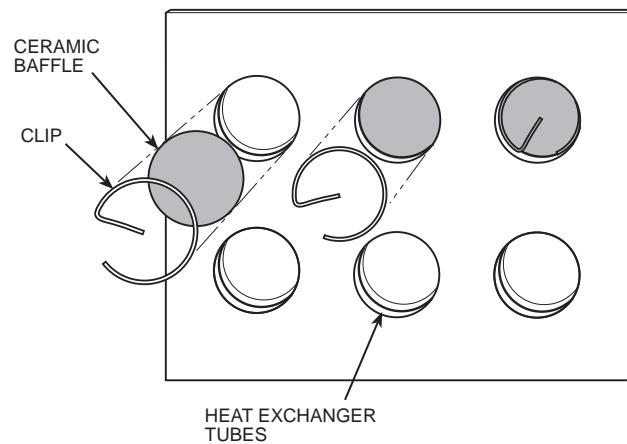


Fig. 52 — Burner Section Detail



NOTE: One baffle and clip will be in each upper tube of the heat exchanger.

Fig. 53 — Removing Heat Exchanger Ceramic Baffles and Clips

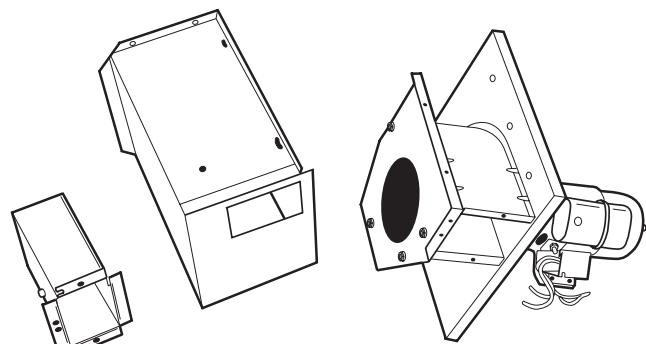
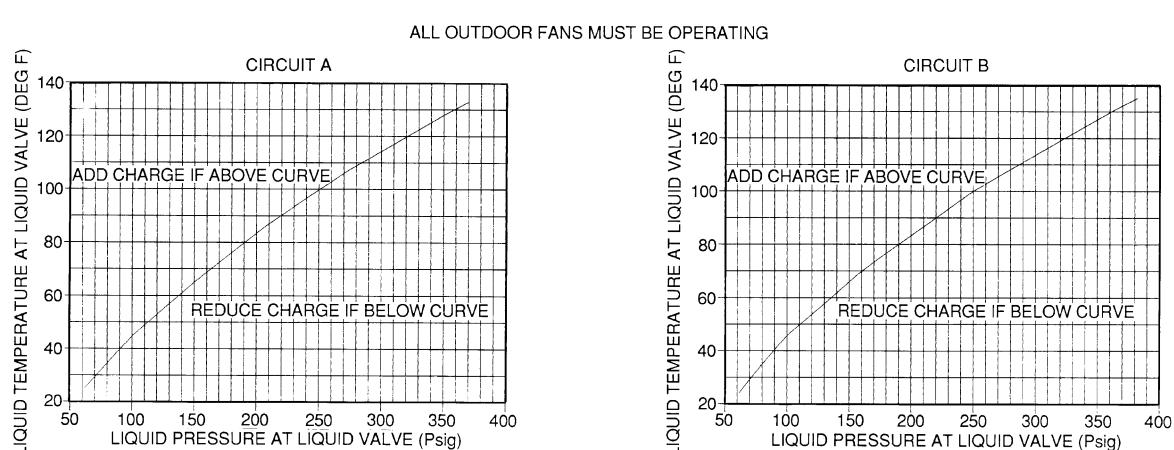
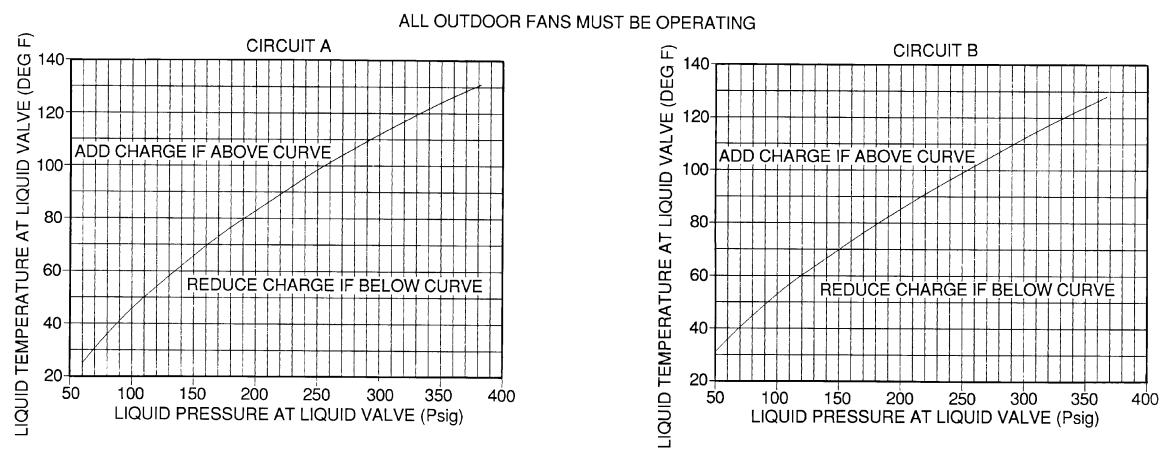
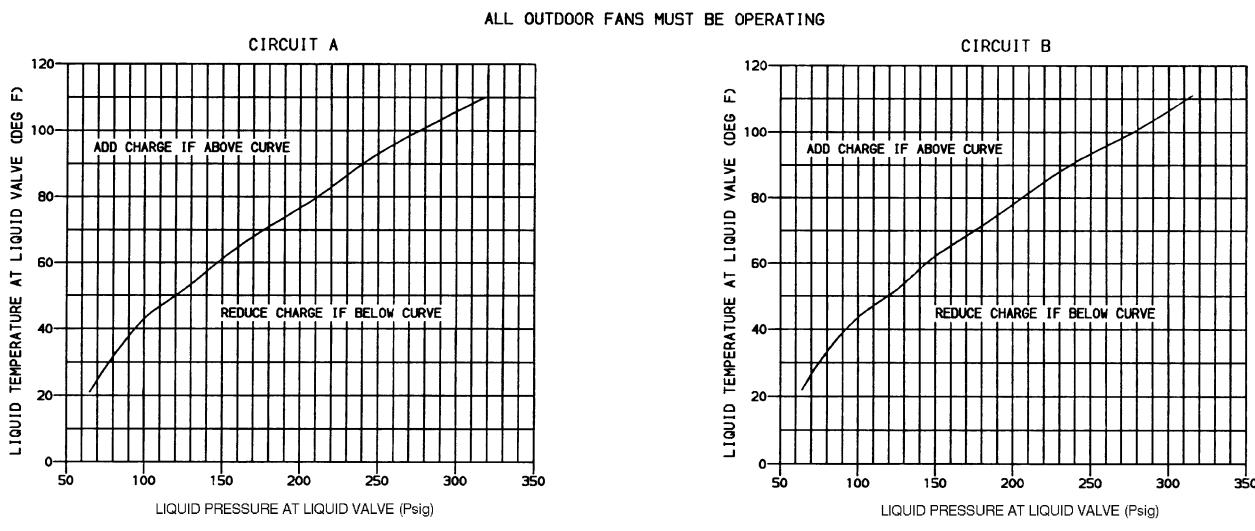
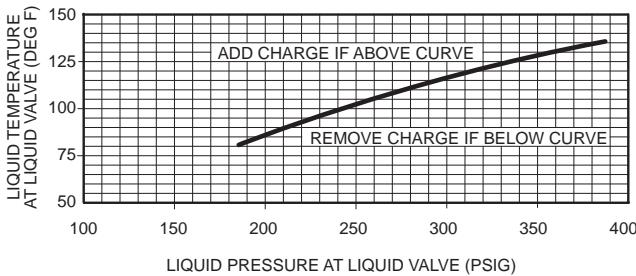


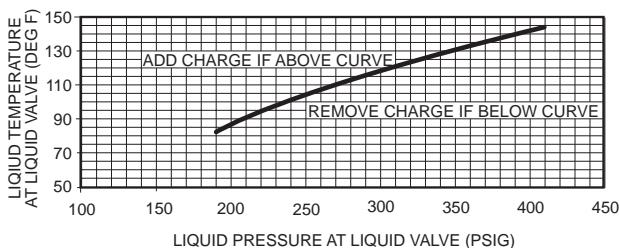
Fig. 54 — Combustion Blower Removal





ALL OUTDOOR FANS MUST BE OPERATING

Fig. 58 — Charging Chart Unit 48/50MP90P



ALL OUTDOOR FANS MUST BE RUNNING

Fig. 59 — Charging Chart — Unit 48/50MP10R

Charging with Unit Off and Evacuated — Close liquid line service valve before charging. Weigh in charge shown in Table 1. Open liquid line service valve; start unit and allow it to run several minutes fully loaded. Check for a clear sight glass. Be sure clear condition is liquid and not vapor. Complete charging the unit.

Charging with Unit Running — If charge is to be added while unit is operating, it is necessary to have all condenser fans and compressors operating. It may be necessary to block condenser coils at low-ambient temperatures to raise condensing pressure to approximately 280 psig (1931 kPag) to turn all condenser fans on. Do not totally block a coil to do this. Partially block all coils in uniform pattern. Charge vapor into compressor low-side service port located above oil pump crank-shaft housing. Charge each circuit until sight glass shows clear liquid.

Oil Charge (Refer to Table 3) — All units are factory charged with oil. Acceptable oil level for each compressor is from $\frac{3}{8}$ to $\frac{1}{8}$ (on 06E299, $\frac{1}{8}$ max) of sight glass (see Fig. 44, page 29).

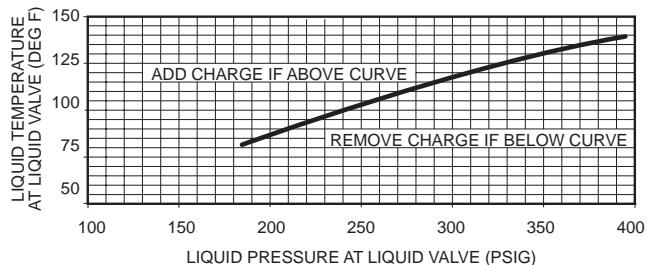
When additional oil or a complete charge is required, use only Carrier-approved compressor oil.

Approved oils are:

Petroleum Specialties, Inc. — Cryol 150A (factory oil charge)
Texaco, Inc. — Capella WF-32-150
Witco Chemical Co. — Suniso 3GS

Do not reuse drained oil, and do not use any oil that has been exposed to atmosphere.

ADD OIL — Close suction shutoff valve and pump down crankcase to 2 psig (14 kPa). (Low-pressure cutout must be jumped.) Wait a few minutes and repeat until pressure remains steady at 2 psig (14 kPa). Remove oil fill plug above the oil level sight glass, add oil through plug hole, and replace plug. Run compressor for 20 minutes and check oil level.



ALL OUTDOOR FANS MUST BE RUNNING

IMPORTANT: For units with 2 compressors per refrigeration circuit, *both compressors must be running* to adjust the oil level. Two oil level equalizer lines between compressors distribute the oil to each compressor.

REMOVE OIL — Pump down compressor to 2 psig (14 kPag). Loosen the $\frac{1}{4}$ -in. (6.4-mm) pipe plug at the compressor base and allow the oil to seep out past the threads of the plug.

NOTE: The crankcase will be slightly pressurized. Do not remove the plug, or the entire oil charge will be lost.

Small amounts of oil can be removed through the oil pump discharge connection while the compressor is running.

Moisture/Liquid Indicator — A clear flow of liquid refrigerant indicates sufficient charge in the system. Bubbles indicate undercharged system or the presence of non-condensables. Moisture in the system measured in parts per million (ppm) changes the color of the indicator:

Green — moisture below 45 ppm (dry)

Chartreuse — 45 to 130 ppm (caution!)

Yellow — moisture above 130 ppm (wet)

Change filter driers at the first sign of moisture in the system. See Carrier Charging Handbook for more information.

IMPORTANT: Unit must be in operation at least 12 hours before moisture indicator can give an accurate reading. With unit running, indicating element must be in contact with liquid refrigerant to give a true reading.

Filter Driers — The 48/50MP units use replaceable core type filter driers, one in each refrigeration circuit. The filter driers are located in the condenser sections, accessible from the right side of the unit.

Replace the filter cores whenever the moisture/liquid indicator shows moisture in the system.

Follow instructions on the packaging for the replacement cores for disassembling and reassembling the filter assemblies and housings.

Liquid Line Service Valve — Located immediately ahead of the filter drier, this valve has a $\frac{1}{4}$ -in. flare connection for field charging. With the liquid circuit shut, the compressor can be used to pump the refrigerant down into the high side. The refrigerant can then be stored there by closing the compressor discharge valve.

Compressor Suction and Discharge Service Valves — Each compressor is provided with suction and discharge service valves. With these valves, the compressor can be isolated from the refrigerant system for servicing or replacing.

High-Pressure Switch — This switch has nonadjustable settings. Figure 60 shows connection on a cylinder head. See Table 31 for pressure switch settings.

Table 31 — Pressure Switch Settings, Psig (kPag)

SWITCH	CUTOFF	CUT-IN
High	426 ± 7 (2935 \pm 48)	320 ± 20 (2205 \pm 138)
Low	27 ± 4 (186 \pm 28)	67 ± 7 (462 \pm 48)

NOTE: High-pressure switch must be removed from cylinder head before removing compressor from the unit.

TO CHECK — Slowly close the discharge shutoff valve until the compressor shuts down. This should be at approximately 426 psig (2935 kPag). Slowly open the valve. When the pressure drops to approximately 320 psig (2205 kPag), the pressure switch resets. To reenergize the control circuit, manually switch the fan circuit breaker off and then on. The compressor starts again under Time Guard® controls.

Low-Pressure Switch — The low-pressure switch (LPS) has fixed nonadjustable settings. It is located at the pump end of the compressor above the bearing head. See Table 31 for pressure switch settings.

TO CHECK — Slowly close the suction cut-off valve and allow the compressor to shut down. This should occur at approximately 27 psig (186 kPag). Slowly open the valve. The compressor restarts under Time Guard control when the pressure builds to approximately 67 psig (462 kPag).

Pressure Relief — High-side pressure relief is provided by a fusible plug in the liquid line at the service valve. For low-side pressure relief, a fusible plug is inserted in the side of the accumulator. See Fig. 60. A pressure relief valve installed on the compressor relieves at 450 psig (3102 kPag).

Adjustments

EVAPORATOR FAN AND POWER EXHAUST MOTOR PLATE — Adjust using a $1\frac{5}{16}$ -in. wrench on the adjusting bolts:

1. Loosen holddown bolts. (See Fig. 61.)
2. Turn the adjusting bolts to move the motor mounting plate toward or away from the fan to loosen or tighten the belts. Make the same number of turns to each bolt.
3. Retighten holddown bolts.

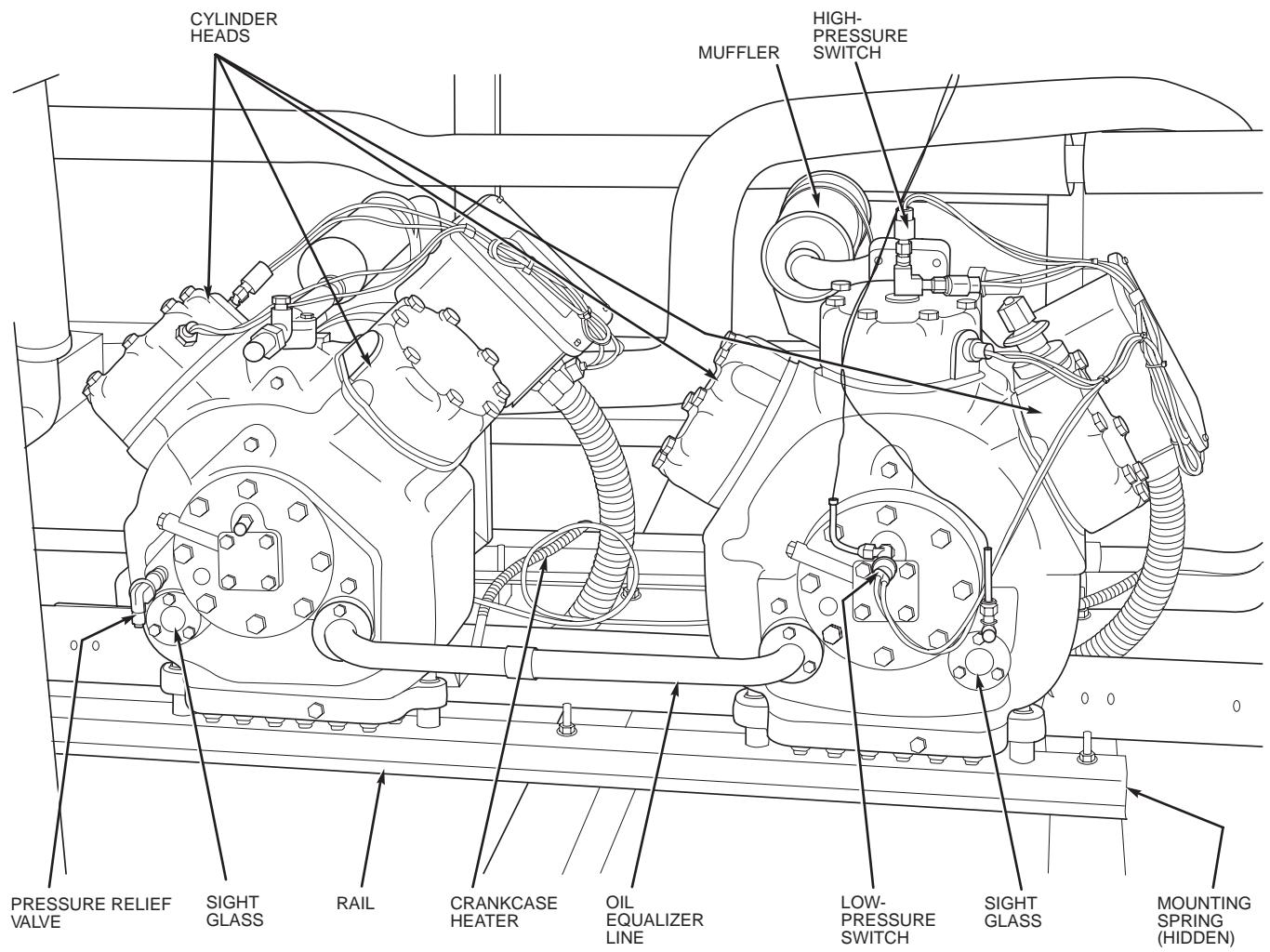
BELT INSTALLATION AND TENSIONING

IMPORTANT: When installing or replacing belts, always use a complete set of new, matched belts to prevent potential vibration problems. Mixing belts often results in premature breakage of the new belts.

1. Turn off unit power.
2. Adjust motor plate so belts can be installed without stretching over the grooves of the pulley. (Forcing the belts can result in uneven belt stretching and a mismatched set of belts.)
3. Before tensioning the belts, equalize belt slack so that it is on the same side of the belt for all belts. Failure to do so may result in uneven belt stretching.
4. Tighten belts using the motor plate adjusting bolts.
5. Adjust until proper belt tension (1/2-in. deflection with one finger) is obtained. Be sure to adjust both adjusting bolts the same number of turns.

NOTE: Check the tension at least twice during the first day of operation, as there is normally a rapid decrease in tension until the belts have run in. Check tension periodically thereafter and keep it at the recommended tension.

With the correct belt tension, belts may slip and squeal momentarily on start-up. This slippage is normal and disappears after wheel reaches operating speed. Excessive belt tension shortens belt life and may cause bearing and shaft damage.



NOTE: Units 48/50MP62L compressors are pan mounted. Units 48/50MP70M and 82N compressors are mounted on rails.

Fig. 60 — 06E Compressors, Typical

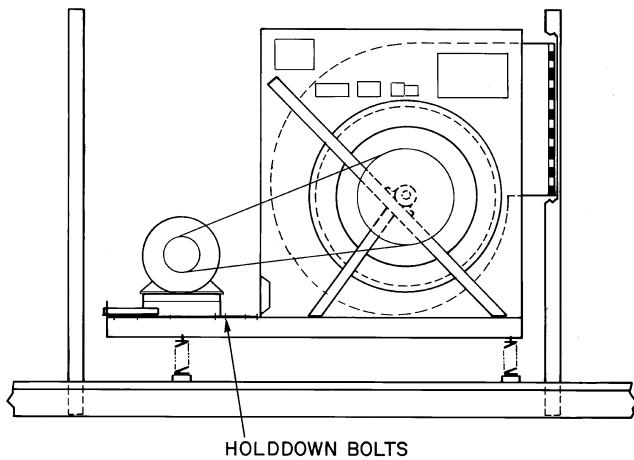


Fig. 61 — Motor Plate Adjustment

PULLEY ALIGNMENT — For proper belt life, the motor and fan pulleys must be properly aligned. To check, first turn off unit power. Place a straightedge against the motor and fan pulleys. See Fig. 62. If the pulleys are properly aligned, the straightedge should be parallel to the belts.

If they are not parallel, check that the motor shaft and fan shaft are parallel. If they are not, adjust the motor plate adjusting bolts until they are.

After verifying that the shafts are parallel, loosen the set-screws on the motor pulley. Move pulley on the shaft until the pulleys are parallel. To move the sheave on the shaft, loosen the belts. If necessary, blower sheave can also be moved on the shaft.

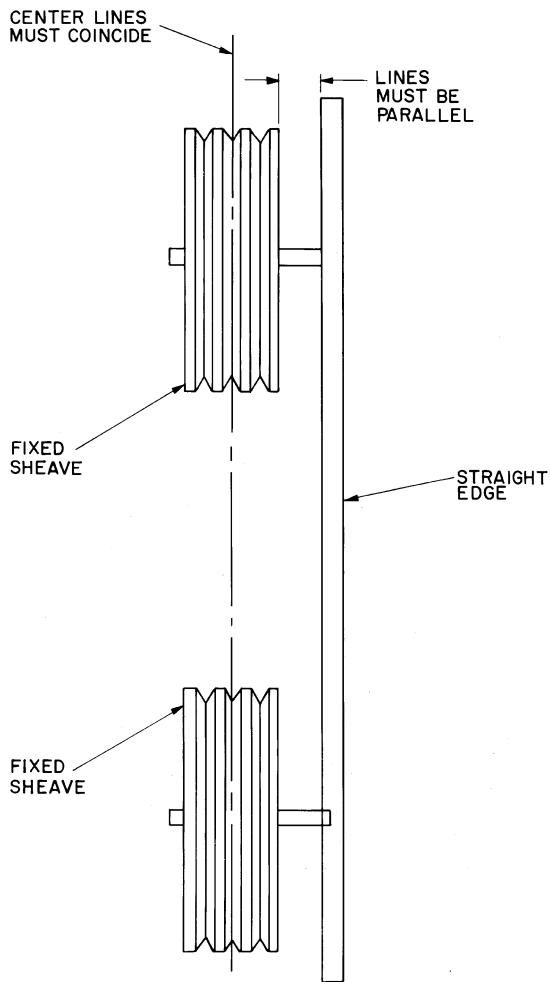


Fig. 62 — Pulley Alignment

Gas Valve Adjustment

NATURAL GAS — The gas valve opens and closes in response to the PIC control or limit control.

When power is supplied to valve terminals D1 and C2, the main valve opens to its preset position.

The regular factory setting is stamped on the valve body (3.3 in. wg).

To adjust regulator:

1. Set thermostat at setting for no call for heat.
2. Turn main gas valve to OFF position.
3. Remove $\frac{1}{8}$ -in. pipe plug from manifold or gas valve pressure tap connection. Install a suitable pressure-measuring device.
4. Set main gas valve to ON position.
5. Set thermostat at setting to call for heat.

6. Remove screw cap covering regulator adjustment screw (see Fig. 63).
7. Turn adjustment screw clockwise to increase pressure or counterclockwise to decrease pressure.
8. Once desired pressure is established, set thermostat setting for no call for heat, turn off main gas valve, remove pressure-measuring device, and replace $\frac{1}{8}$ -in. pipe plug and screw cap.

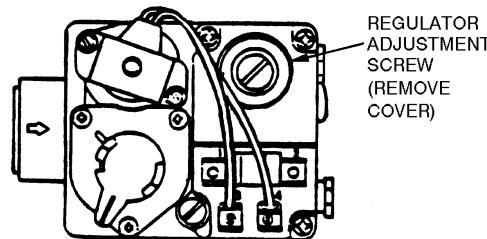


Fig. 63 — Gas Valve

Main Burners — For all applications, main burners are factory set and should require no adjustment.

MAIN BURNER REMOVAL

1. Shut off (field-supplied) manual main gas valve.
2. Shut off power to unit.
3. Remove gas section access door, door frame, and corner post.
4. Disconnect gas piping from gas valve inlet.
5. Remove wires from gas valve.
6. Remove wires from rollout switch.
7. Remove sensor wire and ignitor cable from IGC board.
8. Remove 2 screws securing manifold bracket to basepan.
9. Remove 2 screws that hold the burner support plate flange to the vestibule plate.
10. Lift burner assembly out of unit.

Protective Devices

COMPRESSOR PROTECTION

Overcurrent — Each compressor has one manual reset, calibrated trip, magnetic circuit breaker. Do not bypass connections or increase the size of the circuit breaker to correct trouble. Determine the cause and correct it before resetting the breaker.

Crankcase Heater — Each compressor has a crankcase heater to prevent absorption of liquid refrigerant by oil in the crankcase when the compressor is idle. Since 115-v power for the crankcase heaters is drawn from the unit control circuit, main unit power must be on for the heaters to be energized.

IMPORTANT: After a prolonged shutdown or service job, energize the crankcase heaters for 24 hours before starting the compressor.

Compressor Lockout — If any of the safeties (high-pressure, or low-pressure) trip, or if there is a loss of power to the compressors, the compressors will be locked out. To reset, consult the controls and troubleshooting literature for the appropriate unit for details.

EVAPORATOR-FAN MOTOR PROTECTION — A manual reset, calibrated trip, magnetic circuit breaker protects against overcurrent. Do not bypass connections or increase the size of the breaker to correct trouble. Determine the cause and correct it before resetting the breaker.

CONDENSER-FAN MOTOR PROTECTION — Each condenser-fan motor is internally protected against over-temperature. They are also protected against a severe over-current condition by manual reset, calibrated trip, magnetic circuit breakers on a common circuit. As with the circuit breakers, do not bypass connections or increase breaker size to correct trouble. Determine the cause and correct it before resetting the breaker.

HIGH- AND LOW-PRESSURE SWITCHES — See Fig. 60 for compressor mounting locations. Settings for these switches are shown in Table 33. If either switch trips, that refrigerant circuit will be automatically locked out by the controls. To reset, interrupt control power.

NOTE: When a pressure transducer is used, the low pressure trip point is the same as the low-pressure switch.

Variable Frequency Drive (VFD)

SUPPLY FAN VFD — The optional supply fan VFD is located in the auxiliary control box. Wiring should only be performed by qualified personnel. All parameters have been factory set. Do not change parameters unless necessary.

The VFD can be easily damaged by static electricity. Use proper electrostatic discharge procedures when handling the controls of the VFD.

Never connect main circuit output terminals T1, T2, and T3 to AC main circuit power supply. Always ground the VFD using the designated ground terminal. Refer to the VFD technical manual for more information.

The VFD can indicate faults and alarms. A blinking alarm condition is a warning that a trouble condition will occur or that there is a problem in the external circuitry. The VFD will continue to operate during an alarm condition. Alarm conditions are not entered into the fault register.

A steady fault indicator is displayed when the VFD fault relay has tripped. The motor will coast to a stop, and a fault signal is output is present.

Refer to the VFD technical manual for more information on alarms and faults.

EXHAUST FAN VFD — The optional exhaust fan VFD consists of an exhaust fan, motor, VFD, and pressure transducer. All components (except the transducer) are located in the return air section of the 48/50MP, through the hinged access door. The BP transducer is located in the auxiliary control box. Wiring should only be performed by qualified personnel. All parameters have been factory set. Do not change parameters unless necessary.

The VFD can be easily damaged by static electricity. Use proper electrostatic discharge procedures when handling the controls of the VFD.

Never connect main circuit output terminals T1, T2, and T3 to AC main circuit power supply. Always ground the VFD using the designated ground terminal. Refer to the VFD technical manual for more information.

The VFD can indicate faults and alarms. A blinking alarm condition is a warning that a trouble condition will occur or that there is a problem in the external circuitry. The VFD will continue to operate during an alarm condition. Alarm conditions are not entered into the fault register.

A steady fault indicator is displayed when the VFD fault relay has tripped. The motor will coast to a stop, and a fault signal is output is present.

Refer to the VFD technical manual for more information on alarms and faults.

DISPLAYING FAULT SEQUENCE — Whenever the fault relay trips and shuts down the VFD, the display code of the fault that caused the trip will be displayed until [RESET] is

pressed. The fault code will also be entered into the fault register. The register retains, in sequence, the last 3 fault codes. A newly occurring fault code will not change the fault register if it is a recurrence of the most recently entered fault. The contents of the register can be displayed by performing the following steps:

1. Press [DSP] until the [MONTR] LED is on.
2. Press [▲] until U-09 is displayed.
3. Press [ENTER]. The current fault code will be displayed.
4. Press [▲]. The display will indicate that this is the first code in the memory register.
5. Continue to press [▲] to display the other codes in the fault register. After the last code has been displayed, the sequence will return to the first code.

Control Modules — The standard PSIO1 and optional PSIO2 (processor modules) and standard DSIO1 and DSIO2 (high-voltage relay modules) all perform continuous diagnostic evaluations of the hardware condition. Proper operation of these modules is indicated by 2 light-emitting diodes (LED) on the front surface of the DSIO modules and on the top horizontal surface of the PSIO modules.

RED LED — Blinking continuously at a 3 to 5 second rate indicates proper operation. Lit continuously indicates a problem requiring replacement of the module. Off continuously indicates the power supply should be checked. If there is no input power, check the fuses. If a fuse is bad, check for shorted secondary of the transformer or a bad module.

GREEN LED — On a PSIO module, this is the green light that is closest to the COMM connectors. The other green LED on the module indicates external communications (when used). The green LED should always be blinking when power is on. It indicates that the modules are communicating properly. If the green LED is not blinking, check the red LED. If the red LED is normal, check the module addresses.

NOTE: If the wrong address is entered for the DSIO1 and 2 and/or PSIO1 and 2, then the wrong input channel will be read and the wrong output channel energized.

If all modules indicate a communication failure, check the COMM plug on the PSIO module for proper seating. If a good connection is made and the condition persists, replace the PSIO module.

If only the DSIO module indicates a communication failure, check the COMM plug on that module for a proper connection. If a good connection is made and the condition persists, replace the DSIO module.

All system operating intelligence resides in the PSIO module. This module monitors conditions through the input and output ports and the DSIO modules.

The machine operator communicates with the microprocessor through the HSIO keypad and display module. Communication between the PSIO and the other modules is accomplished by a 3-wire sensor bus. These 3 wires run in parallel from module to module.

On the sensor bus terminal strips, terminal 1 of the PSIO1 module is connected to Terminal 1 of all of the other modules. Terminals 2 and 3 are connected in the same manner. If any of the wires are crossed, the system will not work.

The unit processor modules, the high-voltage relay modules, and the HSIO keypad module are all powered from two 21-vac power sources which connect to terminals 1 and 2 of the power input strip on each module.

Processor Module(s) (PSIO)

INPUTS — Each input channel has 3 terminals; 2 are used.

OUTPUTS — Output of the PSIO module is 24 vdc or 4 to 20 mA dc. There are 3 terminals; 2 are used.

REPLACING DEFECTIVE PSIO MODULES — The replacement part number is printed on a label on the front of the PSIO module. The replacement module order is configured as a generic replacement module, which will require configuration in the field.

Before any service work is started, be sure that all electrical disconnects are open and tagged.

Installation

1. Verify the existing PSIO module is defective by using the procedure described in the Control Modules section on this page.
2. Refer to the Start-Up Checklist on pages CL-1 through CL-4 that should have been completed at start-up. This information is needed later in this procedure. If the checklist does not exist, make a new checklist by filling out the **[3 SRVC]** and **[6 SRVC]** configurations on paper. Tailor the various options and configurations as needed for this particular installation.
3. Check that all power to the unit is off. Switch off all circuit breakers. Carefully disconnect all wires from the defective module by unplugging the 6 connectors. It is not necessary to remove any of the individual wires from the connectors. Remove the green ground wire.
4. Remove the PSIO module mounting screws and remove the module from the control box. Save the screws.
5. With a small screwdriver, set the address switches S1 and S2 on the new PSIO module to match those on the defective module.
6. Mount the new module in the control box using the screws saved in Step 4.
7. Reinstall all 6 wire connectors and the green ground wire.
8. Check all wire connections before restoring power to the unit.
9. Verify that the unit ON/OFF switch is in the ON position.
10. Restore power to the unit and close the control circuit breaker (CCB). Verify that the red and green LEDs respond as described in the Control Modules section on this page. The HSIO keypad should begin its rotating display.
11. Using the HSIO keypad and display module, press **[2 SRVC]** to verify that the software version matches the version number shown on the PSIO label.
12. Press **[3 SRVC]** to verify that the factory configuration codes agree with the values listed in Table 24 on page 37.
13. Set other applicable inputs required in **[3 SRVC]** and **[6 SRVC]** to match the options and accessories installed on the equipment.
14. Enable data reset function to store all data. The HSIO keypad display will blank out after pressing the **[ENTER]** key while displaying data reset (DTRS). The rotating display returns when the data reset has been completed.
15. Press **[3 SRVC]** and verify each item is now configured as needed for this particular installation. Verify the factory default settings for both a specified unit and generic control unit.

16. Press **[6 SRVC]** to check the remainder of the user configuration values.
17. After completing the configuration steps outlined above, close all remaining circuit breakers and perform a unit test.
18. Complete this procedure and restore the unit to normal operation by returning the STANDBY/RUN mode to STBY NO.

High-Voltage Relay Modules (DSIO1 and DSIO2)

INPUTS — Inputs on terminal strip J3 are discrete inputs (on/off). When 24 vac is applied across the 2 terminals in a channel, it reads as an on signal. Zero v is read as an off signal.

OUTPUTS — Terminal strips J4 and J5 are internal relays whose coils are energized by a signal from the microprocessor. The relays switch the circuit to which they are connected. No power is supplied to these connections by the DSIO module.

DSIO REPLACEMENT — Before any service work is started, be sure that all electrical disconnects are opened and tagged.

Installation

1. Verify the existing DSIO module is defective by using the procedure described in the Control Modules section on page 53.
2. Check that all power to the unit is off. Switch off all circuit breakers. Carefully disconnect all wires from the defective module by unplugging the connectors. It is not necessary to remove any of the individual wires from the connectors. Remove the green ground wire.
3. Remove the DSIO module mounting screws and remove the module from the control box. Save the screws.
4. With a small screwdriver, set the address switches S1 and S2 on the new DSIO module to match those on the defective module.
5. Mount the new module in the control box using the screws saved in Step 3.
6. Reinstall all of the wire connectors and the green ground wire.
7. Carefully check all wire connections before restoring power to the unit.
8. Verify that the unit ON/OFF switch is in the ON position.
9. Restore power to the unit and close the control circuit breaker (CCB). Verify that the red and green LEDs respond as described in the Control Modules section on page 53. The LID (keypad) should begin its rotating display.
10. After completing the configuration steps outlined above, close all remaining circuit breakers and perform a unit test.
11. Complete this procedure and restore the unit to normal operation by returning the STANDBY/RUN mode to STBY NO.

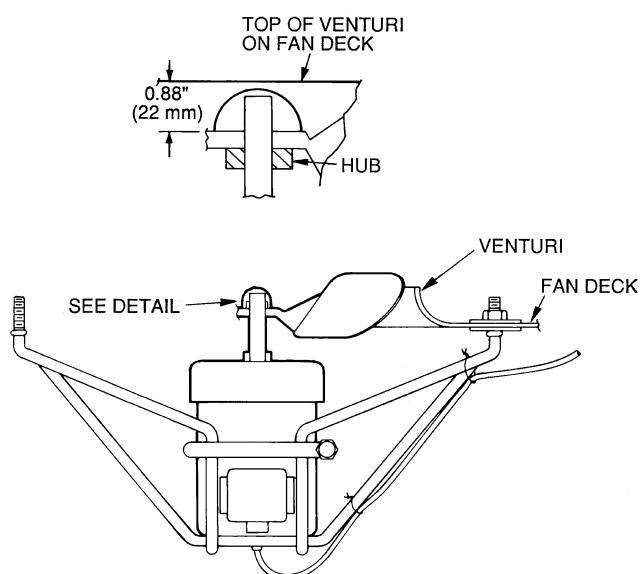
Refrigerant Feed Components — Each refrigerant circuit (2 per unit) has all the necessary refrigerant controls.

Thermostatic Expansion Valve (TXV) — On 48/50MP units, each circuit has 2 TXVs on which superheat may be adjusted if absolutely necessary.

The TXV is set to maintain 10 to 13 F superheat leaving the evaporator coil. It controls the flow of refrigerant to the evaporator coils.

Hot Gas Bypass — An optional hot gas bypass system may be factory installed on circuit no. 1. This system will introduce discharge vapor from the compressor discharge line into the distributors and evaporator coil circuits on circuit no. 1 when suction pressures drop to damaging levels. No field adjustments of the hot gas bypass valve should be required.

Condenser Fans — Each fan is supported by a formed wire mount bolted to fan deck and covered with a wire guard. The exposed end of the fan motor shaft is protected from weather by grease. If fan motor must be removed for service or replacement, be sure to re grease fan shaft and reinstall fan guard. For proper performance, fan should be $\frac{7}{8}$ in. (22 mm) below top of venturi on the fan deck to top of the fan hub. (See Fig. 64.) Tighten set screws to 15 ± 1 ft-lbs (20 \pm 1.3 N-m). Figure 64 shows proper position of mounted fan.



NOTE: Fan rotation is clockwise when viewed from top of unit.

Fig. 64 — Condenser Fan Adjustment

IMPORTANT: Check for proper fan rotation (clockwise viewed from above). If necessary to reverse, switch leads.

Compressor Removal — Access to the pump end of the compressor is from the compressor side of the unit. Access to the motor end of the compressor is from the inside of the unit. All compressors can be removed from the compressor side of the unit.

IMPORTANT: All compressor mounting hardware and support brackets removed during servicing must be re-installed prior to start-up.

1. Disconnect power to unit; lockout power to compressor.
2. Close suction and discharge service valves.
3. Relieve refrigerant pressure into a refrigerant recovery system.
4. Remove:
 - a. Fan-cycling pressure switch (FCPS)
 - b. High-pressure switch
 - c. Low-pressure switch

5. Disconnect power wires at terminal box and disconnect conduit.

6. Disconnect wires from crankcase heater.

7. Disconnect service valves from compressor.

NOTE: On units with 2 compressors per circuit, disconnect both oil equalizer lines located on the motor barrel and on the oil pump sump.

8. Units 48/50MP62L:

a. Remove 4 large screws securing compressor mounting pan to unit base rail.

b. Slide compressor (on mounting pan) to outside of unit frame; support and/or lower to ground.

c. Unbolt compressor from mounting pan and remove.

9. Units 48/50MP70M,82N,90P,10R:

a. Remove 4 large screws securing compressor to the compressor rails.

b. Lift compressor off mounting bolts and remove.

Compressor Replacement — Perform the following:

1. Reverse procedure in Compressor Removal section to end of Step 4.

2. Reinstall service valves and safety switches, and tighten to torques as listed:

TORQUE	COMPRESSOR(S)
Tighten discharge valves to —	
20-25 ft-lbs (27-34 N-m)	06E-250
80-90 ft-lbs (109-122 N-m)	06E-265,275,299
Tighten suction valves to —	
80- 90 ft-lbs (109-122 N-m)	06E-250
90-120 ft-lbs (122-163 N-m)	06E-265,275,299
Tighten the following fittings as specified —	
120 in.-lbs (13.5 N-m)	High-Pressure Switch
120 in.-lbs (13.5 N-m)	Low-Pressure Switch

3. Leak-check and evacuate system, reclaim refrigerant.
4. Recharge system per pre-start-up and start-up sequences. Recheck oil levels.
5. Energize crankcase heater for 24 hours prior to restart of system.

TROUBLESHOOTING

The 48/50MP units provide extensive troubleshooting information to service personnel through the use of status codes and alarm and alert codes from the control system, which are displayed on the unit HSIO or through the use of Service Tool or CCN Building Supervisor. For more information on diagnostics, codes, and possible causes, refer to the Controls and Troubleshooting manual.

Use the Quick Test function to check control inputs and outputs (including economizer actuators). Refer to Controls and Troubleshooting Guide.

If there are indications of hunting (rapid oscillations) of control functions (such as duct static pressure or supply air temperature), or if the response rate is too slow, check the gain values. Refer to the Control Loop Checkout section on page 40 for more information.

If the unit is equipped with an optional VFD and the supply or exhaust fan is not running when required, refer to the troubleshooting section of the separate VFD technical manual provided with the unit.

For troubleshooting information on mechanical systems, refer to the troubleshooting and diagnostics table on the next page.

TROUBLESHOOTING AND DIAGNOSTICS

PROBLEM	SOLUTION
COMPRESSOR DOES NOT RUN	
<u>Contactor Open</u> <ol style="list-style-type: none"> 1. Power off. 2. Fuses blown in field power circuit. 3. Alarm tripped. 4. No control power. 5. Compressor circuit breaker tripped. 6. Safety device lockout circuit active. 7. Low-pressure switch open. 8. High-pressure switch open. 9. Loose electrical connections. 10. Compressor stuck. 	<ol style="list-style-type: none"> 1. Restore power. 2. After finding cause and correcting, replace with correct size fuse. 3. Check alarm history on HSIO. 4. Check secondary fuse(s); replace with correct type and size. Replace transformer if primary windings receiving power. 5. Check for excessive compressor current draw. Reset breaker; replace if defective. 6. Reset lockout circuit at HSIO or circuit breaker. 7. Check for refrigerant undercharge, obstruction of indoor airflow, or whether compressor suction shutoff valve is fully open. Make sure liquid line solenoid valve(s) is open. 8. Check for refrigerant overcharge, obstruction of outdoor airflow, air in system or whether compressor discharge valve is fully open. Be sure outdoor fans are operating correctly. 9. Tighten all connections. 10. See 06E compressor service literature.
<u>Contactor Closed</u> <ol style="list-style-type: none"> 1. Compressor leads loose. 2. Motor windings open. 3. Single phasing. 	<ol style="list-style-type: none"> 1. Check connections. 2. See 06E compressor service literature. 3. Check for blown fuse. Check for loose connection at compressor terminal.
COMPRESSOR STOPS ON HIGH-PRESSURE SWITCH	
<u>Outdoor Fan On</u> <ol style="list-style-type: none"> 1. High-pressure switch faulty. 2. Airflow restricted. 3. Air recirculating. 4. Noncondensables in system. 5. Refrigerant overcharge. 6. Line voltage incorrect. 7. Refrigerant system restrictions. 	<ol style="list-style-type: none"> 1. Replace switch. 2. Remove obstruction. 3. Clear airflow area. 4. Purge and recharge as required. 5. Purge as required. 6. Consult power company. 7. Check or replace filter drier, expansion valve, etc. Check that compressor discharge valve is fully open.
<u>Outdoor Fan Off</u> <ol style="list-style-type: none"> 1. Fan slips on shaft. 2. Motor not running. 3. Motor bearings stuck. 4. Motor overload open. 5. Motor burned out. 	<ol style="list-style-type: none"> 1. Tighten fan hub setscrews. 2. Check power and capacitor. 3. Replace bearings. 4. Check overload rating. Check for fan blade obstruction. 5. Replace motor.
COMPRESSOR CYCLES ON LOW-PRESSURE SWITCH	
<u>Indoor-Air Fan Running</u> <ol style="list-style-type: none"> 1. Filter drier plugged. 2. Expansion valve power head defective. 3. Low refrigerant charge. 	<ol style="list-style-type: none"> 1. Replace filter drier. 2. Replace power head. 3. Add charge. Check low-pressure switch setting.
<u>Airflow Restricted</u> <ol style="list-style-type: none"> 1. Coil iced up. 2. Coil dirty. 3. Air filters dirty. 4. Dampers closed. 	<ol style="list-style-type: none"> 1. Check refrigerant charge. 2. Clean coil fins. 3. Clean or replace filters. 4. Check damper operation and position.
<u>Indoor-Air Fan Stopped</u> <ol style="list-style-type: none"> 1. Electrical connections loose. 2. Fan relay defective. 3. Motor overload open. 4. Motor defective. 5. Fan belt broken or slipping. 	<ol style="list-style-type: none"> 1. Tighten all connections. 2. Replace relay. 3. Power supply. 4. Replace motor. 5. Replace or tighten belt.

LEGEND

HSIO — Human Sensory Input/Output Device

DSIO — Processor Module

VFD — Variable Frequency Drive

TROUBLESHOOTING AND DIAGNOSTICS (cont)

PROBLEM	SOLUTION
COMPRESSOR RUNNING BUT COOLING INSUFFICIENT	
Suction Pressure Low	<ol style="list-style-type: none"> 1. Refrigerant charge low. 2. Head pressure low. 3. Air filters dirty. 4. Expansion valve power head defective. 5. Indoor coil partially iced. 6. Indoor airflow restricted.
Suction Pressure High	<ol style="list-style-type: none"> 1. Unloaders not functioning. 2. Compressor valve defective. 3. Heat load excessive.
UNIT OPERATES TOO LONG OR CONTINUOUSLY	<ol style="list-style-type: none"> 1. Low refrigerant charge. 2. Control contacts fused. 3. Air in system. 4. Partially plugged expansion valve or filter drier.
SYSTEM IS NOISY	<ol style="list-style-type: none"> 1. Piping vibration. 2. Compressor noisy.
COMPRESSOR LOSES OIL	<ol style="list-style-type: none"> 1. Leak in system. 2. Crankcase heaters not energized during shutdown.
FROSTED SUCTION LINE Expansion valve admitting excess refrigerant.	Adjust expansion valve.
HOT LIQUID LINE	<ol style="list-style-type: none"> 1. Shortage of refrigerant due to leak. 2. Expansion valve opens too wide.
FROSTED LIQUID LINE Restricted filter drier.	Remove restriction or replace.
COMPRESSOR WILL NOT UNLOAD	<ol style="list-style-type: none"> 1. Defective unloader. 2. Defective capacity control solenoid valve. 3. Miswired capacity control liquid line solenoid.
COMPRESSOR WILL NOT LOAD	<ol style="list-style-type: none"> 1. Miswired capacity control liquid line solenoid. 2. Defective capacity control solenoid valve. 3. Plugged strainer (high side). 4. Stuck or damaged unloader piston or piston ring(s).
CONTACTOR OPEN	<ol style="list-style-type: none"> 1. Power off. 2. Fuses blown in field power circuit. 3. No control power. 4. No demand by unit control. 5. Fan status switch not closed. 6. VFD overload function tripped. 7. Motor leads loose. 8. Motor windings open. 9. Single phasing. 10. Belts broken or thrown. 11. Fan status switch contacts defective.
CONTACTOR CLOSED	<ol style="list-style-type: none"> 1. No output signal from control at PSIO no. 1, channel 16. 2. Communication failure at VFD. 3. Fan status switch contacts defective.

LEGEND

HSIO — Human Sensory Input/Output Device

DSIO — Processor Module

VFD — Variable Frequency Drive

Refer to Fig. 65 for IGC troubleshooting information.

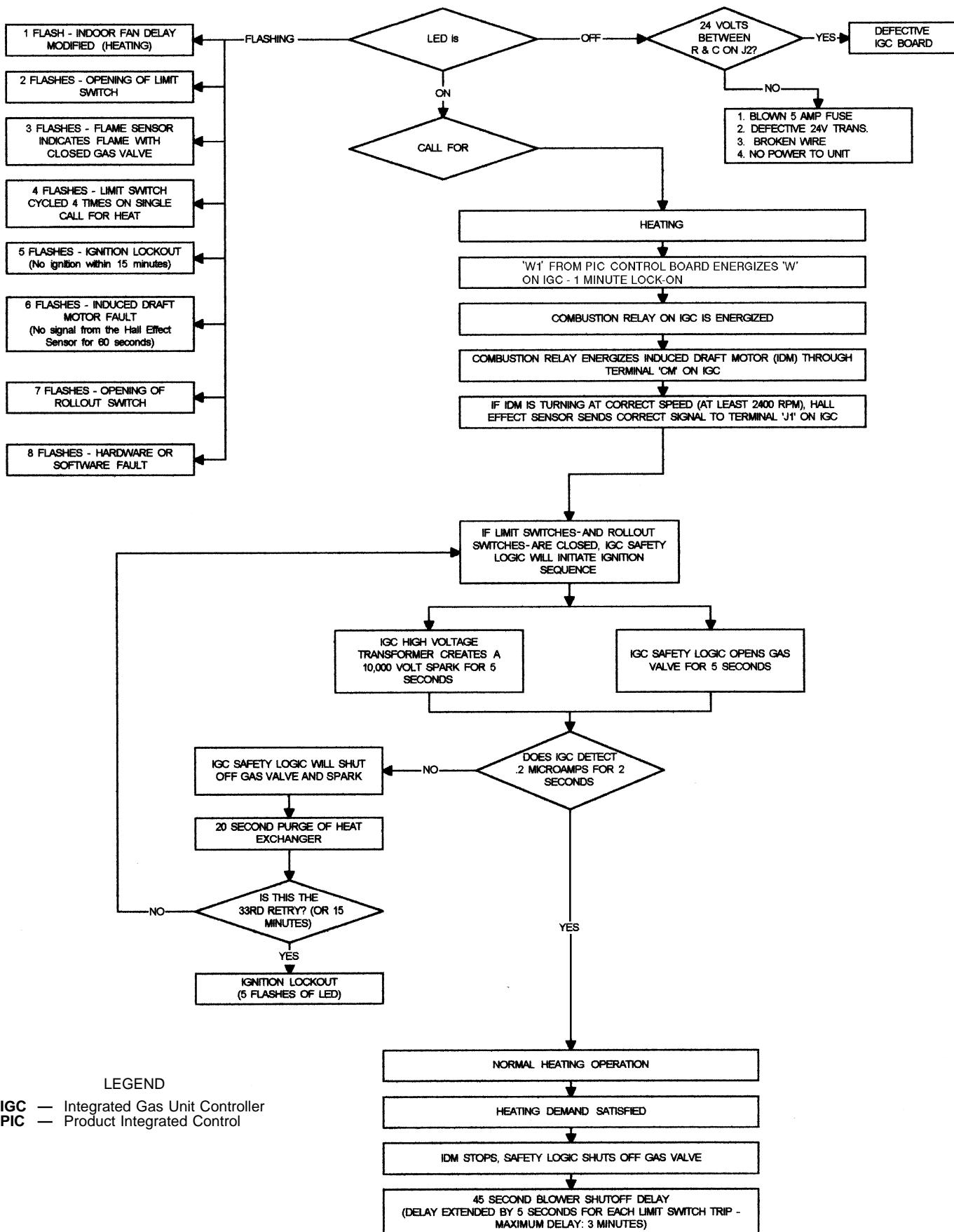


Fig. 65 — IGC Control (Heating) — 48MP Units Only

PACKAGED SERVICE TRAINING

Packaged Service Training programs are an excellent way to increase your knowledge of the equipment discussed in this manual, including:

- Unit Familiarization
- Installation Overview
- Maintenance
- Operating Sequence

A large selection of product, theory, and skills programs are available, using popular video-based formats and materials. All include video and/or slides, plus companion book.

Classroom Service Training which includes “hands-on” experience with the products in our labs can mean increased confidence that really pays dividends in faster troubleshooting and fewer callbacks. Course descriptions and schedules are in our catalog.

CALL FOR FREE CATALOG 1-800-962-9212

[] Packaged Service Training [] Classroom Service Training

START-UP CHECKLIST

MODEL NO.: _____

SERIAL NO.: _____

DATE: _____

TECHNICIAN: _____

I. PRE-START-UP:

- VERIFY THAT UNIT IS LEVEL
- VERIFY THAT ALL PACKING MATERIALS HAVE BEEN REMOVED FROM UNIT
- LOOSEN ALL SHIPPING HOLDDOWN BOLTS AND REMOVE SHIPPING BRACKETS PER INSTRUCTIONS
- VERIFY THAT COMPRESSOR SUSPENSION SPRINGS HAVE BEEN LOOSENERED PER INSTRUCTIONS
- VERIFY ASSEMBLY OF ECONOMIZER HOOD
- VERIFY INSTALLATION OF EXHAUST HOOD
- VERIFY THAT CONDENSATE CONNECTION IS INSTALLED PER INSTRUCTIONS
- VERIFY THAT POWER SUPPLY MATCHES UNIT DATA PLATE
- VERIFY THAT ALL ELECTRICAL CONNECTIONS AND TERMINALS ARE TIGHT
- CHECK GAS PIPING FOR LEAKS (48MP ONLY)
- CHECK THAT INDOOR-AIR FILTERS ARE CLEAN AND IN PLACE
- CHECK FAN WHEEL AND PROPELLER FOR LOCATION IN HOUSING/ORIFICE, AND VERIFY SET SCREW IS TIGHT
- VERIFY THAT FAN SHEAVES ARE ALIGNED AND BELTS ARE PROPERLY TENSIONED
- OPEN SUCTION, DISCHARGE, AND LIQUID LINE SERVICE VALVES
- CHECK COMPRESSOR OIL LEVEL SIGHT GLASS AND VERIFY PROPER LEVEL
- VERIFY THAT CRANKCASE HEATERS HAVE BEEN ENERGIZED FOR 24 HOURS
- CHECK VOLTAGE IMBALANCE

LINE-TO-LINE VOLTS: AB _____ V AC _____ V BC _____ V

(AB + AC + BC)/3 = AVERAGE VOLTAGE = _____ V

MAXIMUM DEVIATION FROM AVERAGE VOLTAGE = _____ V

VOLTAGE IMBALANCE = 100 X (MAX DEVIATION)/(AVERAGE VOLTAGE) = _____ %

IF OVER 2% VOLTAGE IMBALANCE, DO NOT ATTEMPT TO START SYSTEM!
CALL LOCAL POWER COMPANY FOR ASSISTANCE.

II. PRELIMINARY CHECKLIST ITEMS (DETERMINE BEFORE CONFIGURING CONTROLS):

CONTROL SETTINGS FOR NON-NETWORKED, FREESTANDING UNIT

- UNIT TO BE OPERATED ON CONSTANT AIR VOLUME (CV) RATHER THAN VARIABLE-AIR VOLUME (VAV)
- CONFIRM THAT SPACE TEMPERATURE SENSOR (T55) HAS BEEN WIRED CORRECTLY PER SPACE TEMPERATURE SENSOR (T55) SECTION ON PAGE 17.
- CONFIRM THAT TUBING FOR SPACE AND SUPPLY DUCT PRESSURES HAS BEEN INSTALLED
- SET ENTHALPY CONTROL SET POINT ON ECONOMIZER
- SET SUPPLY FAN AND "CHECK FILTER" STATUS SWITCHES FOR JOB REQUIREMENTS

UNIT OPTION CHECKLIST

ITEM	PRESENT?	
A	<input type="checkbox"/>	CONSTANT VOLUME POWER EXHAUST
B	<input type="checkbox"/>	VARIABLE VOLUME POWER EXHAUST
C	<input type="checkbox"/>	VARIABLE FREQUENCY DRIVE ON SUPPLY FAN (VAV ONLY)
D	<input type="checkbox"/>	HOT GAS BYPASS
E	<input type="checkbox"/>	VAV WITH OCCUPIED HEAT

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

III. PRELIMINARY CHECKLIST ITEMS (cont)

CHANGES TO DEFAULT VALUES

RECORD ALL CHANGES MADE TO FACTORY DEFAULT VALUES

IV. START-UP

CHECK EVAPORATOR FAN SPEED AND RECORD. _____

CHECK CONDENSER FAN SPEED AND RECORD. _____

AFTER AT LEAST 10 MINUTES RUNNING TIME, RECORD THE FOLLOWING MEASUREMENTS:

	COMP A1	COMP A2	COMP B1	COMP B2
OIL PRESSURE	_____	_____	_____	_____
SUCTION PRESSURE	_____	_____	_____	_____
SUCTION LINE TEMP	_____	_____	_____	_____
DISCHARGE PRESSURE	_____	_____	_____	_____
DISCHARGE LINE TEMP	_____	_____	_____	_____
ENTERING CONDENSER AIR TEMP	_____	_____	_____	_____
LEAVING CONDENSER AIR TEMP	_____	_____	_____	_____
EVAP ENTERING AIR DB TEMP	_____	_____	_____	_____
EVAP ENTERING AIR WB TEMP	_____	_____	_____	_____
EVAP LEAVING AIR DB TEMP	_____	_____	_____	_____
EVAP LEAVING AIR WB TEMP	_____	_____	_____	_____
COMPRESSOR AMPS (L1)	_____	_____	_____	_____
COMPRESSOR AMPS (L2)	_____	_____	_____	_____
COMPRESSOR AMPS (L3)	_____	_____	_____	_____

ELECTRICAL

SUPPLY FAN AMPS _____ EXHAUST FAN AMPS _____

ELECTRIC HEAT AMPS L1 _____ L2 _____ L3 _____

TEMPERATURES

OUTDOOR-AIR TEMPERATURE _____ F DB (Dry-Bulb)

RETURN-AIR TEMPERATURE _____ F DB _____ F WB (Wet-Bulb)

COOLING SUPPLY AIR _____ F

PRESURES

GAS INLET PRESSURE _____ IN. WG

GAS MANIFOLD PRESSURE STAGE NO. 1 _____ IN. WG STAGE NO. 2 _____ IN. WG

REFRIGERANT SUCTION CIRCUIT NO. 1 _____ PSIG CIRCUIT NO. 2 _____ PSIG

REFRIGERANT DISCHARGE CIRCUIT NO. 1 _____ PSIG CIRCUIT NO. 2 _____ PSIG

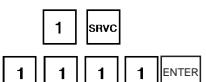
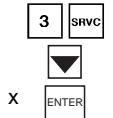
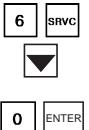
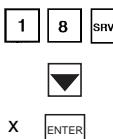
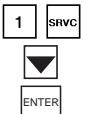
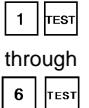
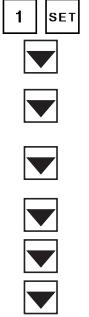
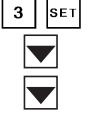
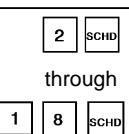
VERIFY REFRIGERANT CHARGE USING CHARGING CHARTS ON PAGES 48 AND 49

GENERAL

ECONOMIZER MINIMUM VENT AND CHANGEOVER SETTINGS TO JOB REQUIREMENTS

CHECK THE COMPRESSOR OIL LEVEL SIGHT GLASSES; ARE THE SIGHT GLASSES SHOWING OIL LEVEL PER INSTRUCTIONS ON PAGE 29. (Y/N) _____

PERFORM CONTROL CONFIGURATION PROCEDURE ON PAGES CL-3 AND CL-4.

CONTROL CONFIGURATION		
KEYBOARD ENTRY	DISPLAY	DESCRIPTION VALUES IN [] INDICATE FACTORY DEFAULTS
	LOG ON LOGGEDON	Enter password followed by  Logged on okay
	FACT CFG TYPE X TYPE X	Factory configuration Unit type (0 = CV, 1 = VAV) [Default is 1] Verify unit type and change if necessary. If CV unit, see CV control configuration.
	DTRS	Data Reset Enable Data Reset
	FACT CFG LLAG X DISABLE	Factory Configuration Use  to access lead/lag option — disable with HGBP (Item D, page CL-1) Disable lead/lag (0 = DIS, 1 = ENB) [1]
	BLD PRES BPS .05 BPS X	Configure building pressure control (modulating power exhaust) Use  for building pressure set point (range 0 to .5) [.05] Set building pressure set point per job requirements
	LOGGEDON LOG OFF LOGD OFF	Access log on/off function Use  to access log off Logged off okay
	INPUTS	Run quick test to verify operation of unit functions (see Controls and Troubleshooting Guide)
	SETPOINT OHSP X OCSP X UHSP X UCSP X SPSP X SASP X	Set system set points per job requirements Set occupied heat set point (Range 55-80 F) [68] CV only Set occupied cool set point (Range 55-80 F) [78] CV only Set unoccupied heat set point (Range 40-80 F) [55] Set unoccupied cool set point (Range 75-95 F) [90] Set supply duct pressure set point (Range 0-5.0 in. wg) [1.5] Set supply air set point temperature (Range 45-70 F) [55]
	TIME dow.hh.mm mm.dd.yy	Current time/date Set day of week and time Set month, day, and year
	DAYLIGHT	Set daylight savings time begin/end dates. Required if job conditions require adjustment of clock for daylight savings time (see Controls and Troubleshooting Guide)
	HOLIDAY	Set holiday dates. Required if job conditions require a different schedule on holidays than other days (see Controls and Troubleshooting Guide)
	PERIOD X	Set occupied/unoccupied schedules. Required if job conditions require unit to enter unoccupied cycle at programmed times of day or days of week (see Controls and Troubleshooting Guide)

NOTE: Data in brackets [] is default value.

CONSTANT VOLUME CONTROL CONFIGURATION

KEYBOARD ENTRY	DISPLAY	DESCRIPTION
	FACT CONFIG FANM	Fan Mode
	FANMx	Select Fan Mode (Auto. = 0, Cont. = 1) [1]
	ECONOMIZER SMG x.x SMG 8.0	Configure Economizer Submaster Gain Set SMG to 8.0 [-7.5[

NOTES: